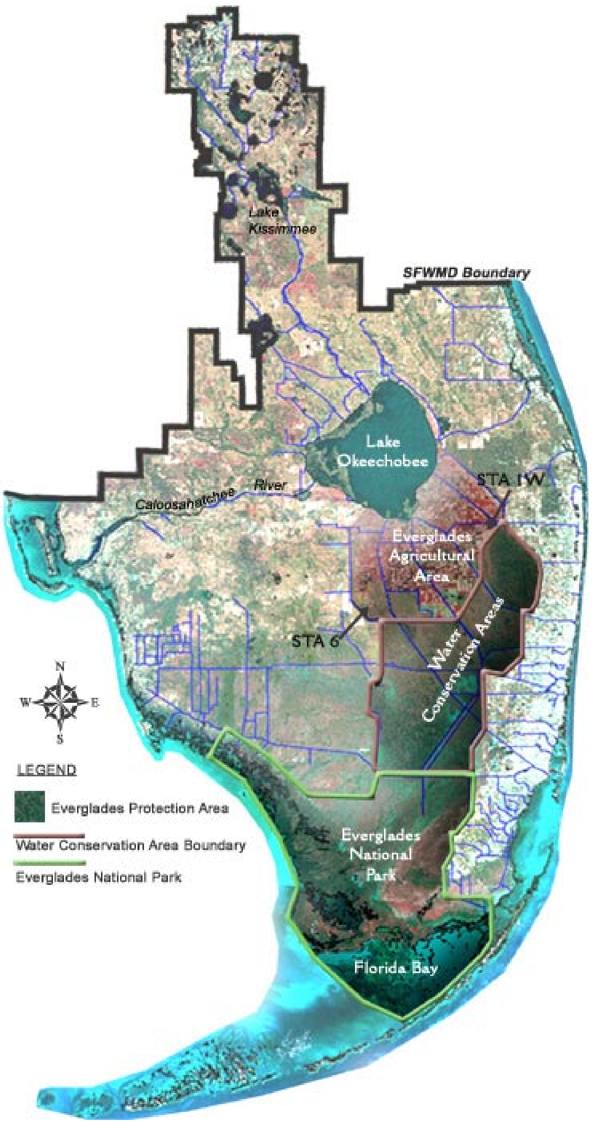
APRIL 2001

Environmental Monitoring and Assessment Division
South Florida Water Management District



Environmental Conditions Update April 2001 Summary *This issue of the Environmental Conditions Update analyzes data collected from* ***October 1 through December 31, 2000****. The major rainfall event of the quarter was from October 2 through October 4, caused by a poorly organized subtropical disturbance that caused excessive flooding in Miami-Dade County. November and December had rainfall volumes that were 19 and 51 percent, respectively, of their monthly historical averages. The total phosphorus load entering Lake Okeechobee during the fourth quarter was only 37 metric tons due to low inflows to the lake. The total phosphorus load discharged from the Everglades Agricultural Area to the conservation areas during the fourth quarter was 55.5 metric tons. Stormwater Treatment Areas had low to negligible inflows and outflows in November and December, precluding complete calculations of total phosphorus reductions and loads for the entire quarter. The Arthur R. Marshall Loxahatchee National Wildlife Refuge met the calculated interim and long-term total phosphorus levels in January and February, but the Refuge was too dry in March to apply the limits. Inflows to the Everglades National Park through Shark River Slough exceeded the interim and long-term flow-weighted mean total phosphorus concentration limits, whereas inflows through Taylor Slough and the Coastal Basins met the 11 ppb long-term limit.*

CONTENTS

RAINFALL

SUMMARY

Monthly rainfall for October, November and December 2000 in various rainfall basins and storm water treatment areas is presented in **Table 1**. The monthly rainfall totals are weighted averages of data from rainfall gages reported in the District daily rainfall report compiled by Water Resources Operations and from other agencies collecting rainfall data in south Florida.

Historically the occurrence of rainfall in south Florida during the dry months (November through April) has been generally associated with occasional disturbances such as cold fronts, while during the wet months (June through September) attributed to frequent thunderstorms, tropical storms or hurricanes. May and October have been considered transitional months and can be either wet or dry.

October rainfall District-wide averaged 4.48 inches or 116 percent of the monthly historical average. The major rainfall event of the month, from the 2nd through the 4th, was caused by a poorly organized subtropical disturbance that resulted in excessive flooding in Miami-Dade County. Almost all of the October rain fell during these three days. November was the driest in thirty years. Most of the rain fell from the 24th through the 26th. Overall, District-wide rainfall averaged 0.43 inches or 19 percent of the monthly historical average. The December rainfall ranged from 0.35 inches over Lake Okeechobee to 4.63 inches over eastern Miami-Dade County. The Lower Kissimmee Valley's annual rainfall for 2000 was the driest since at least 1914. Overall, the December District-wide rainfall averaged 0.98 inches or 51 percent of the monthly historical average. Yearly District-wide rainfall for 2000 was 39.46 inches or 76 percent of the historic average. This total rainfall for 2000 tied with 1961 as the second driest year since 1938.

The effects of this quarter's overall below-average rainfall can be observed in low inflows and total phosphorus loads entering Lake Okeechobee in November and December (**Figure 2)** and low phosphorus loads calculated for the EAA November and December (**Figure 8**).

Table 1. Monthly weighted rainfall averages (inches)

Rainfall Basin	Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Oct-00	Nov-00	Dec-00	12-Month Moving Total
Upper Kissimmee	1.2	0.2	0.8	1.5	1.2	6.7	8.4	6.0	4.9	0.9	0.7	0.9	33.4
Lower Kissimmee	1.2	0.2	1.5	1.7	0.5	4.4	7.8	3.4	6.1	1.2	0.2	0.6	28.8
Lake Okeechobee	1.1	0.6	1.8	3.3	0.9	4.5	5.3	2.8	7.0	1.6	0.3	0.4	29.6
East EAA	1.0	0.8	2.3	4.8	4.8	4.8	7.3	3.5	6.0	5.9	0.2	0.4	41.8
West EAA	0.9	0.9	1.6	5.1	1.6	6.1	6.3	3.9	7.2	9.0	0.1	0.6	43.3
WCAs 1&2	1.2	0.4	5.7	3.8	1.0	4.1	9.1	4.1	6.0	6.6	0.3	0.7	43.0
WCA 3	0.7	1.1	2.4	5.4	0.9	7.3	7.9	4.3	7.1	6.6	0.1	0.8	44.6
ENP	***0.4***	***0.5***	***1.0***	***3.6***	***2.0***	***6.9***	***6.9***	***5.0***	***3.9***	***5.6***	***1.6***	***1.8***	39.2
C111 Basin	0.6	0.9	1.6	3.6	1.9	6.6	9.7	7.7	9.1	10.7	0.5	2.7	55.6
STA-1W	0.7	0.8	3.7	4.4	0.9	1.4	10.0	2.3	6.3	9.8	0.3	0.1	40.7
STA6	0.3	1.0	2.3	3.6	0.4	4.7	11.7	3.1	10.0	16.9	0.0	0.4	54.4

Italisized and bolded values are based on estimate average of rainfall at stations CHEKIKA and S332R

LAKE OKEECHOBEE DRAINAGE BASIN

SUMMARY

MAP

Phosphorus Loading and Rainfall Trends

Historic and monthly data for rainfall, flows and phosphorus loads to Lake Okeechobee are presented for 1999 (**Figure 1**) and for 2000 (**Figure 2**). In both figures, monthly values for each of these parameters are depicted as bars. Solid lines represent monthly means based on the previous 20-years of data. A 20-year period was chosen because it provided a quality-assured data set for water quality and covered both drought and wet conditions. The dashed and dotted lines in each figure depict the 95 percent confidence interval about this 20-year mean. In other words, a 95 percent chance exists that a value will fall within that confidence level (**Figures 1** and **2**).

Monthly rainfall shown in each of the figures is presented as area-weighted averages from a network of meteorological stations in the Upper Kissimmee, Lower Kissimmee and Lake Okeechobee basins. Flows are compiled from directly measured data at 26 monitoring stations that discharge into the lake. Phosphorus loads to the lake were calculated by multiplying concentration data from those 26 monitoring stations and their respective flow data.

The effects of the Shared Adversity Plan (Resolution No. 00-31) on Lake Okeechobee is described in the October 2000 Issue of the *Environmental Conditions Update* (SFWMD, 2000).

Higher phosphorus loads have typically occurred during wetter months (June through October), while lower loads occur during drier months of the year (**Figures 1** and **2**). In 1999, the period from June through October (excluding July) exhibited higher rainfall than the 20-year average for these months. As a result, flows and phosphorus loads for these five months were greater than their 20-year means (**Figure 1**). Flows and loads for all the months of 2000 were below their 20-year averages (**Figure 2**).

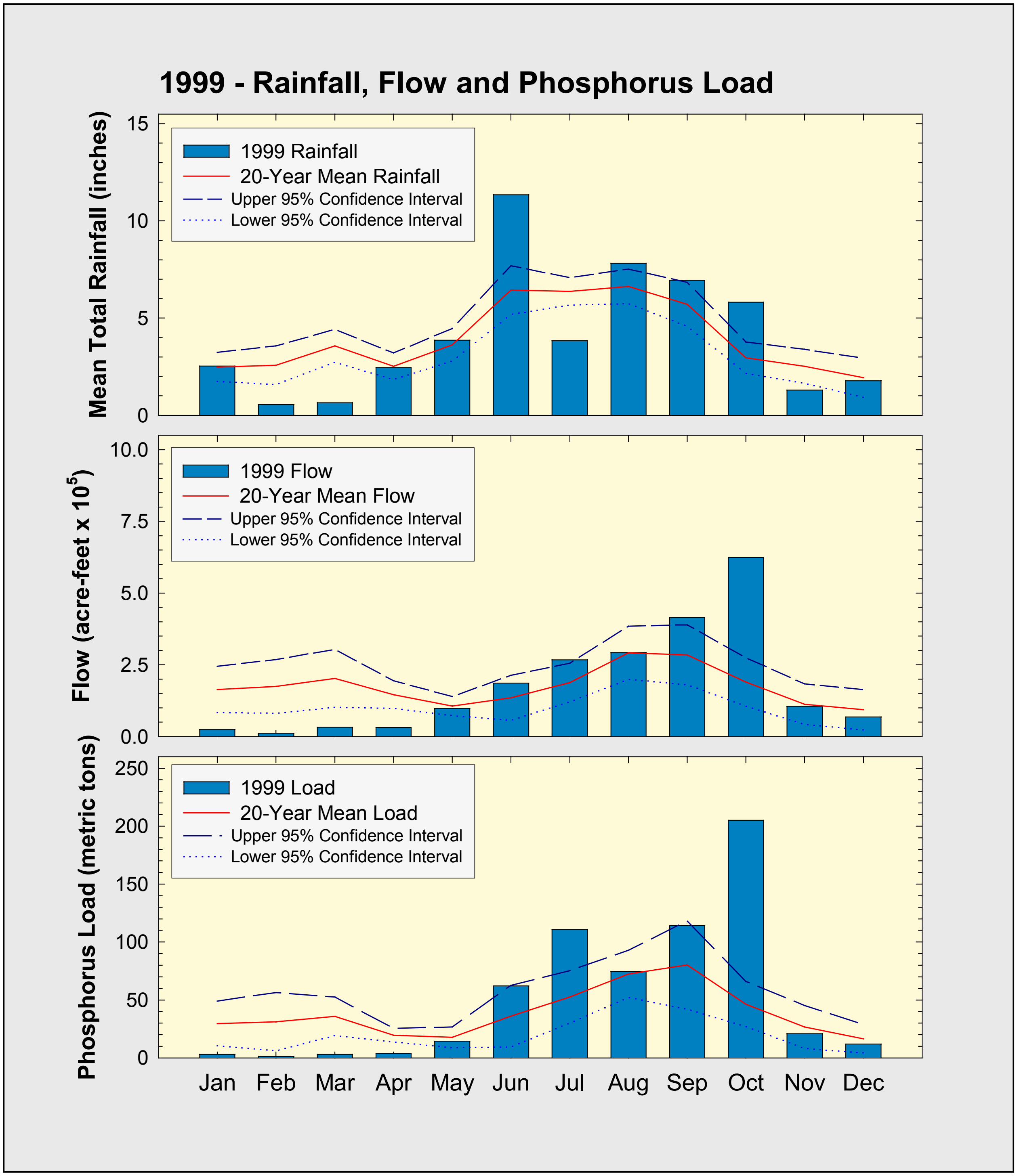


Figure 1. Monthly total phosphorus rainfall, flow and loads for Lake Okeechobee during 1999.

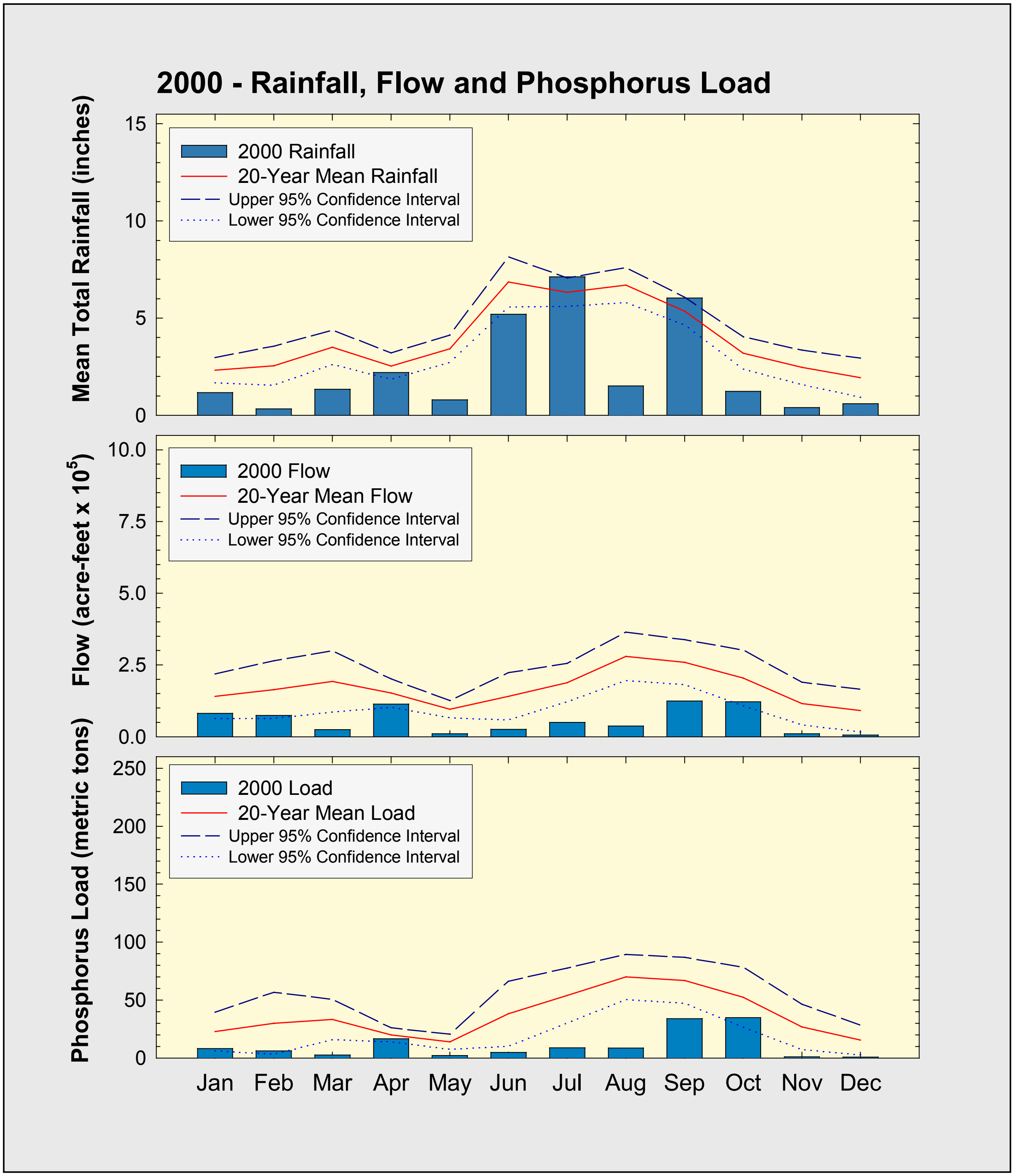


Figure 2. Monthly total phosphorus rainfall, flow and loads for Lake Okeechobee during 2000.

Major climatic disturbances (such as El Niño, tropical storms and hurricanes) can alter the seasonal distribution of phosphorus to Lake Okeechobee. During October 1999, scheduled releases of water from Lake Kissimmee combined with Hurricane Irene contributed to the 205 metric tons of phosphorus released to Lake Okeechobee for that month (**Figure 1**).

During the fourth quarter of 2000, monthly rainfall amounts for October, November and December 2000 were 1.2, 0.4 and 0.6 inches, respectively, across the Lake Okeechobee Basin (**Figure 2**) with November being one of the driest in 30 years. A poorly organized subtropical disturbance passed through south Florida in early October with most of the rainfall associated with this system falling south of the lake. Most of the October rainfall recorded in the Lake Okeechobee Basin is attributed to this disturbance. In 1999, the rainfall amounts for these corresponding months were 5.8, 1.3, and 1.8 inches (**Figure 1**) or approximately 7 inches more than in the fourth quarter of 2000. Monthly rainfall amounts recorded in October through December 2000 were below the 95 percent confidence interval for these months, based on the previous 20 years of data (**Figure 2**).

Lower average rainfall during the fourth quarter resulted in lower flows and phosphorus loads to the lake (**Figure 2**). Phosphorus loads to Lake Okeechobee in October, November and December 2000 were 35, 1.1 and 0.9 metric tons, respectively, compared to 205, 21 and 12 metric tons during the corresponding months in 1999.

Approximately 44 percent of the phosphorus load entering the lake in the fourth quarter of 2000 was from backpumping at S2 and S3 from October 4-6, 2000 and from periodic releases from the Loxahatchee National Wildlife Refuge through Culvert 10A. In addition, approximately 8 percent of the total load entered Lake Okeechobee through S308 as a result of higher water elevations in the C-44 canal than in the lake. In contrast, the phosphorus load from the Kissimmee River through S65E accounted for less than five percent of the total load to the lake during the fourth quarter. Overall, the phosphorus load for the fourth quarter of 2000 was approximately 2.5 times lower than the 20-year average for the same period (**Figure 2**).

Phosphorus Concentrations for Tributaries and Basins

A phosphorus concentration target for each basin in the Lake Okeechobee Watershed was established under the 1989 Interim Surface Water Improvement and Management (SWIM) Plan. This target was incorporated to ensure a reduction in phosphorus loads to Lake Okeechobee. Under this SWIM Plan, the phosphorus concentration from each basin must either be below 180 parts-per-billion (ppb) or at the 1989-discharge concentration, whichever is less.

The Lower Kissimmee River, S154, Fisheating Creek and Taylor Creek/Nubbin Slough Basins are generally major contributors of phosphorus load to the lake. Flow-weighted mean concentrations of total phosphorus from these four basins were used to calculate the 12-month moving average concentrations shown in **Figure 3**.

Since May 1991, the phosphorus concentrations for the Kissimmee River Basin have consistently been at or below the target concentration of 180-ppb (**Figure 3a**). Phosphorus concentrations from the Kissimmee decreased from 106 ppb in October 2000 to 93 ppb in December 2000.

During the first five months of 2000, phosphorus concentrations from the S-154 Basin were about 850 ppb. Phosphorus concentrations decreased to 440 ppb in November 2000 (**Figure 3a**). By December, the 12-month moving average total phosphorus concentration increased to 510 ppb.

The moving average phosphorus concentrations in Fisheating Creek have varied above and below the 180-ppb target level. From October 1996 through September 1999, the phosphorus concentrations in the creek were consistently above the target (**Figure 3b**). From October 1999 through September 2000, phosphorus concentrations remained below the target limit. However, phosphorus concentrations increased during the fourth quarter, reaching 310 ppb by December 2000.

A sharp increase in phosphorus concentrations from about 650 ppb to over 870 ppb was observed for the Taylor Creek/Nubbin Slough Basin from September 1999 through September 2000 (**Figure 3b**). The 12-month moving average total phosphorus concentrations were approximately 250 ppb lower in October and November of 2000 compared to September 2000. By December 2000, the phosphorus concentration increased slightly to 620 ppb.

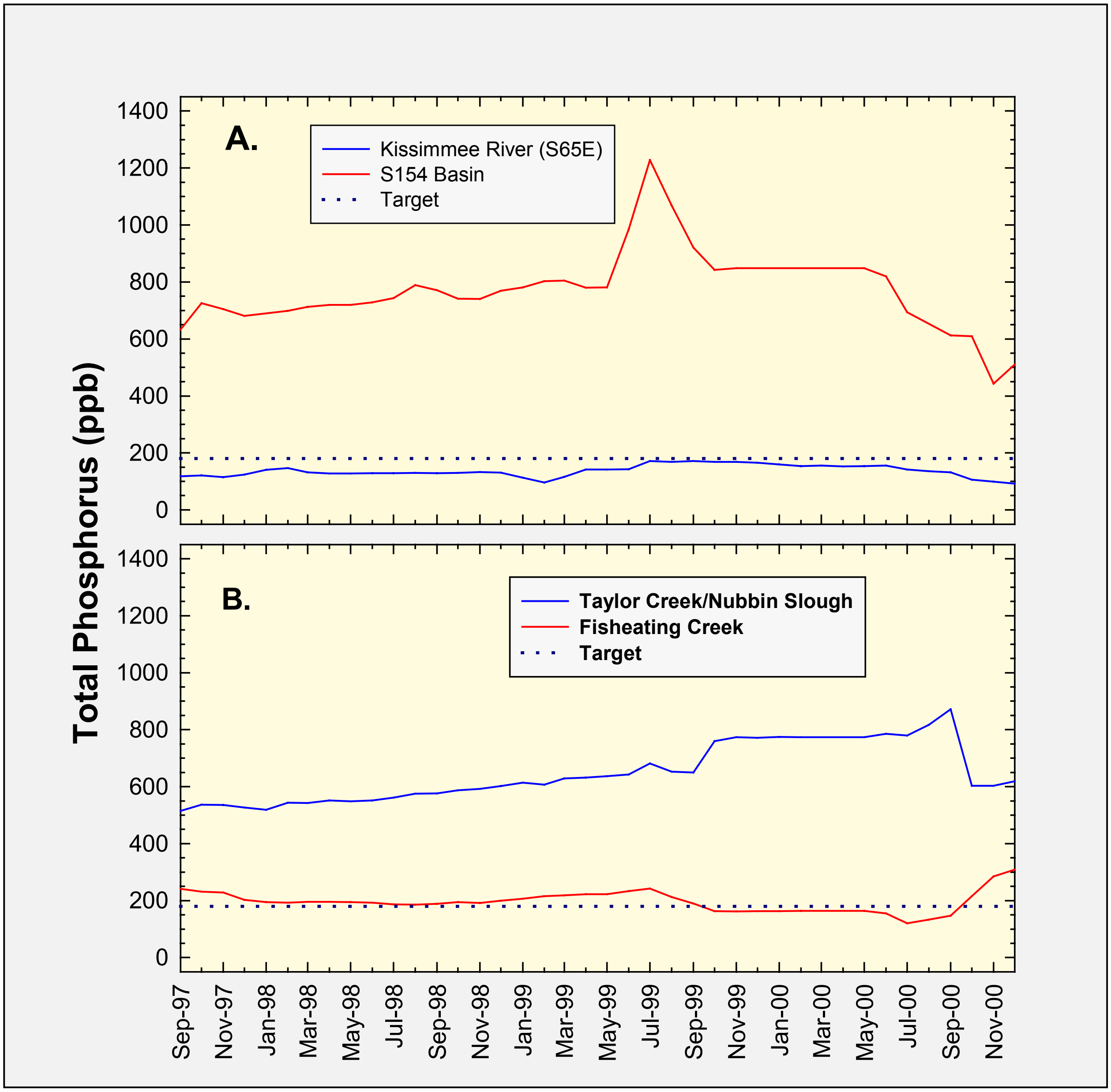


Figure 3. Twelve-month moving flow-weighted mean total phosphorus concentrations for: a. Kissimmee River and S154 Basins and b. Taylor Creek/ Nubbin Slough and Fisheating Creek. The four basins/tributaries drain into Lake Okeechobee.

Long-Term Analysis

A long-term analysis of phosphorus loads is provided as a 5-year moving average calculated at the end of each calendar year. These averages are calculated for actual and target phosphorus loads. The actual load consists of the inflow from tributaries to the lake each year plus an assumed contribution from atmospheric deposition of 64.4 metric tons per year (**Figure 4a**). The target load is calculated using the modified Vollenweieder model. The difference between the target and actual loads is referred to as the ***over-target load*** and is presented in **Figure 4b**. The actual, target, over-target and 5-year moving average loads are summarized in **Table 2** for the period from 1973 through 2000.

Over the past decade, several programs have been implemented to reduce phosphorus loads to Lake Okeechobee. These programs include best management practices (BMPs), dairy buy-outs, regulatory programs for non-dairy uses of land, and minimizing limited backpumping to the lake from the Everglades Agricultural Area (EAA). It is apparent that these programs by themselves will not be sufficient to achieve the required in-lake concentration and associated load reduction and, therefore, must be supplemented with other load reduction measures. The Lake Okeechobee Water Retention/ Phosphorus Removal Critical Restoration Project has been developed to increase regional water storage north of Lake Okeechobee by on-site wetland restoration and water retention, with a secondary benefit of reducing phosphorus in surface runoff. Currently, 12 potential sites have been identified. Two are for proposed stormwater treatment (attenuation) facilities, which the U.S. Army Corps of Engineers will design and construct. At the other 10 sites, the District has proposed to design and construct modifications to improve stormwater retention, restore wetlands and improve the quality of discharged water. These proposed project sites are located throughout the northern Lake Okeechobee watershed, in the lower Kissimmee River Basins (S-65D and S-65E), S-154, and the Taylor Creek-Nubbin Slough Basins (S-191).

In-Lake Total Phosphorus Concentrations

Lake Okeechobee has a long history of excessive phosphorus loading, which has resulted in major changes in the ecosystem, including an increased frequency of algal blooms, predominantly blue-green algae, and the accumulation of over 30,000 metric tons of phosphorus in the lake sediments. From the early 1970s to the 1990s, total phosphorus concentrations in the lake's water column increased from below 50 ppb to over 100 ppb. Present high total phosphorous concentrations are a function of high external loads and frequent resuspension of phosphorous-rich mud bottom sediments caused by wind. The South Florida Water Management District and other agencies have initiated an aggressive program to reduce external phosphorus loads to the lake and are conducting a feasibility study to determine the ecological, engineering and economic implications of reducing the internal phosphorous load from the lake's sediments.

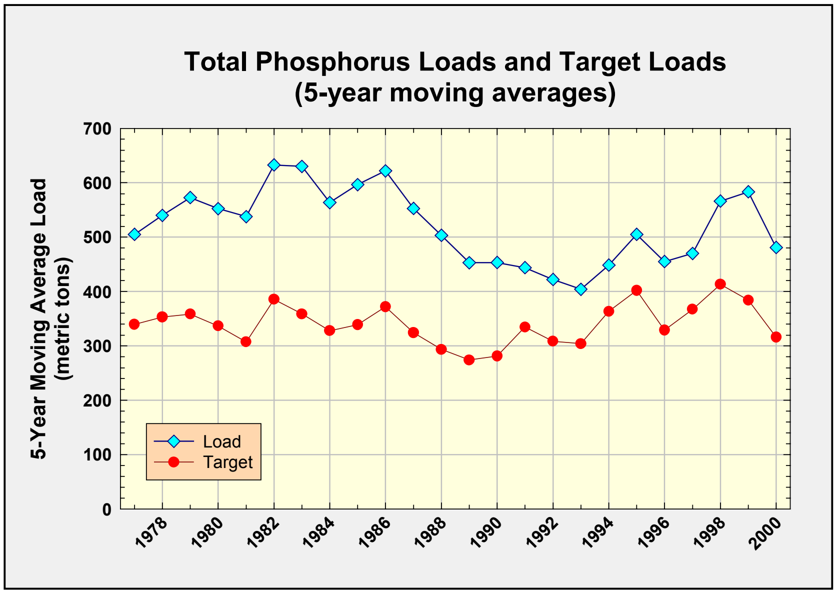


Figure 4a. Comparison of the actual load o the target load. Data are 5-year moving averages.

Figure 4b. The 5-year moving average of over-target loading to Lake Okeechobee. This data is the difference between the actual load and the target load depicted in **Figure 4**a.

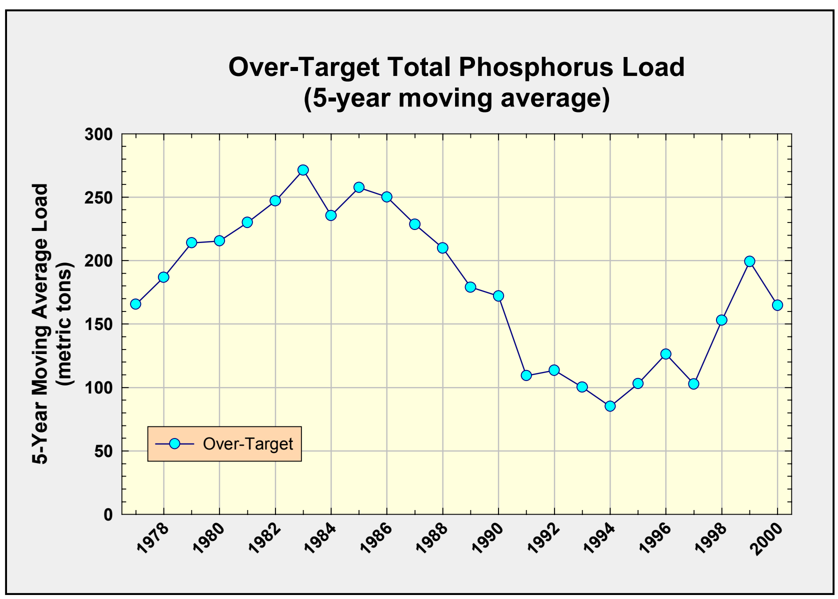


Table 2. Historic Total Phosphorus Loading Data

Year	Actual Load (metric ton)	Target Load (metric ton)	Annual Over Target (metric ton)	Long-Term Over-Target (5-yr moving average)
1973	499	476	22	
1974	802	414	389	
1975	361	266	95	
1976	467	285	182	
1977	397	257	140	166
1978	672	544	128	187
1979	966	441	524	214
1980	260	157	102	215
1981	393	138	255	230
1982	873	648	225	247
1983	659	409	250	271
1984	634	288	345	235
1985	424	211	213	258
1986	521	303	217	250
1987	526	410	117	228
1988	413	256	157	210
1989	382	191	191	179
1990	425	247	178	172
1991	474	570	-96	109
1992	418	280	137	114
1993	323	232	90	100
1994	604	488	116	85
1995	707	440	267	103
1996	225	205	20	126
1997	492	472	20	103
1998	804	462	342	153
1999	689	342	347	199
2000	194	100	94	165

In order to assess the seasonal and spatial variations in phosphorus concentrations in the lake resulting from inputs as well as internal cycling, distribution plots of open-water total phosphorus concentrations are presented in **Figures 5a** through **5c**.

The arithmetic mean concentration of total phosphorus was 111, 55 and 148 ppb for October, November and December, respectively. By comparison, total phosphorus concentrations for the corresponding months in 1999 were 94, 190 and 184 ppb, respectively. During the fourth quarter, total phosphorus concentrations ranged from 13 to 363 ppb.

The contour plot shown in **Figure 5a** depicts total phosphorus concentrations for October 2000. Approximately 36 percent of the total phosphorus concentrations measured for this month were less than 100 ppb (**Figure 5a**). Total phosphorus concentrations greater than 100 ppb extended from the eastern shore to the central portion of the lake. The higher phosphorus concentrations measured in the eastern portion of the lake may reflect the effects of backflow of water from the C-44 canal through the S308 structure and inflow through Culvert 10A. More importantly, wind from the subtropical disturbance in the first part of October may have resuspended the fine-grained sediments in the lake resulting in the higher phosphorus concentrations observed for the month.

By November 2000, total phosphorus concentrations decreased throughout the lake. Approximately 75 percent of phosphorus concentrations measured in the lake were below 100 ppb (**Figure 5b**). Fisheating Bay, located in the western portion of Lake Okeechobee, as well as the near shore areas in the southwestern portion of the lake had total phosphorus concentrations lower than 40 ppb. Overall, the lower phosphorus concentrations measured in November 2000 may reflect the combined influence of two phenomena. First, low amounts of phosphorus from the watershed entered the lake due to reduced rainfall. Second, the lowered lake levels, as well as absence of windy conditions, allowed for suspended material to settle quickly.

Phosphorus concentrations in the lake increased in December with 70 percent of the lake’s surface water having levels greater 100 ppb. Concentrations greater than 200 ppb extended from the central portion of the lake to the northeastern shores (**Figure 5c**). The lowest loads of phosphorus to Lake Okeechobee in the fourth quarter occurred in December 2000. Therefore, the increased phosphorus concentrations for the month are probably not a result of inflows. A more probable source for the increased phosphorus may be resuspension of the phosphorus-rich, fine-grained sediments. Wind action generated by late fall fronts probably resuspended these sediments and increased the overall phosphorus content of the lake.

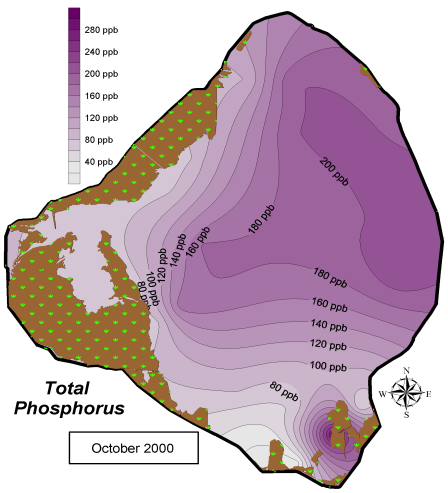


Figure 5a.
Total phosphorus concentrations for open water monitoring sites in Lake Okeechobee, October 2000.

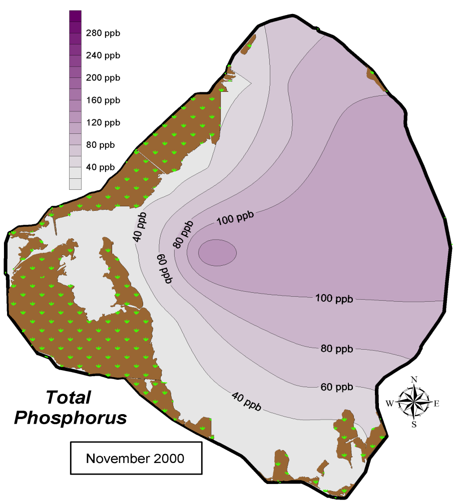
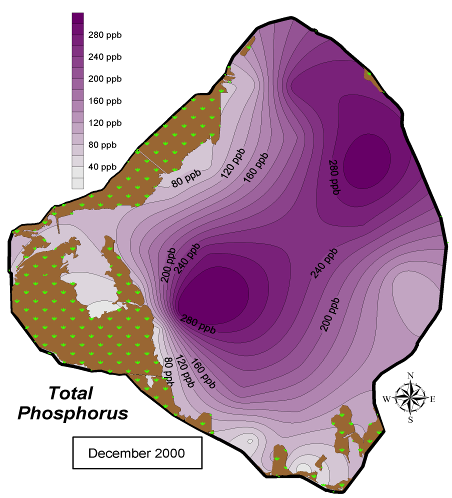


Figure 5b.
Total phosphorus concentrations for open water monitoring sites in Lake Okeechobee, in the first half of November 2000.

Figure 5c.
Total phosphorus concentrations for open water monitoring sites in Lake Okeechobee, in the second half of December 2000.



Light Penetration

Secchi depth is a measure of how deep light penetrates the water column. The Secchi depth is measured by lowering a 30-cm diameter white disk through the water column until it is just visible. At the Secchi depth, solar light penetrating the water is reflected off the surface of the disk in a quantity sufficient to come back through the water and reach the observer's eye. The amount and composition of suspended material along with the presence of dissolved colored substances in the water column affect Secchi depth. When either of these two variables is high, light will not penetrate deeply into the water column (*i.e.*, Secchi depth decreases).

The transmission of light in lakes and other bodies of water is extremely important because solar radiation is the primary source of energy for photosynthetic organisms such as algae and aquatic plants. An increase in light penetration can cause increased photosynthetic activity, resulting in higher primary productivity if nutrients are not limiting.

Contour plots depicting Secchi depths in Lake Okeechobee during the fourth quarter corresponded to the contours plots for phosphorus (**Figures 6a** to **6c**). The average Secchi depths for October , November and December 2000 were 0.3, 0.7 and 0.3 meters, respectively.

Light penetration in Lake Okeechobee extended to a maximum depth of 0.6 meters in October 2000 (**Figure 6a**). However, approximately 83 percent of the lake had light penetrating to a depth less than 0.4 meters. Secchi depths lower than 0.2 meters extended from the central through northeastern portions of the lake.

By November, light penetration in Lake Okeechobee improved. Approximately 58 percent of the lake had Secchi depths greater than 0.4 meters. In the southwestern region of the lake, light penetration extended to a maximum depth of 1.2 meters (**Figure 6b**).

Approximately 88 percent of the lake in December 2000 had light penetrating to less than 0.4 meters (**Figure 6c**). Secchi depths less than 0.2 meters covered approximately 51 percent of the lake and stretched from the south-central portion to the eastern and northeastern shores.

An inverse relationship between Secchi depth and total phosphorous was also observed during the fourth quarter of 2000. In other words, higher total phosphorus concentrations were observed in regions having lower Secchi depths. Average Secchi depths measured during the fourth quarter of 2000 improved by approximately 0.2 meters compared to the corresponding period in 1999.

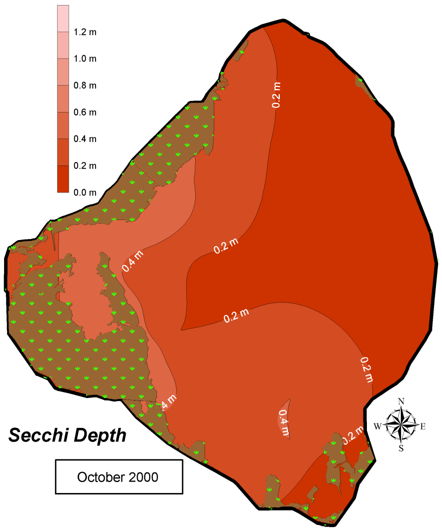


Figure 6a. Depth of light penetration (Secchi depth) measured in meters for Lake Okeechobee, first half of October 2000.

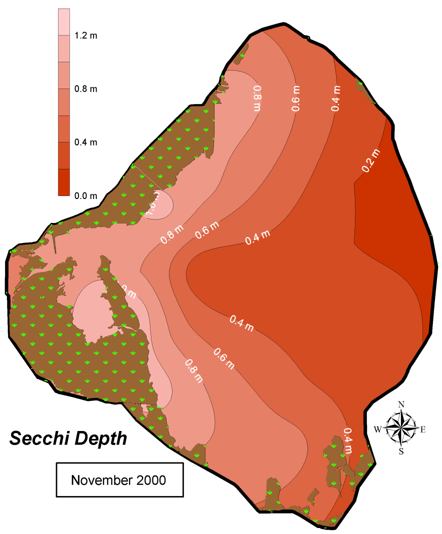


Figure 6b. Depth of light penetration (Secchi depth) measured in meters for Lake Okeechobee, first half of November 2000.

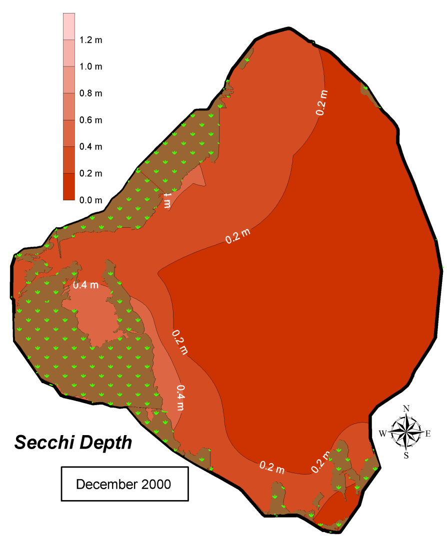


Figure 6c. Depth of light penetration (Secchi depth) measured in meters for Lake Okeechobee, second half of December

Chlorophyll *a* Concentrations

Chlorophyll *a* is a green pigment present in terrestrial and aquatic plants, including algae. This pigment functions to absorb visible light. The energy associated with the absorbed light is used to drive photosynthesis. Chlorophyll *a* concentrations are an indicator of the amount of living plant (or algal) material in a water body.

Naturally occurring algal populations present in Lake Okeechobee will form blooms under certain weather and water quality conditions.

Algal blooms are dense concentrations of algae over large areas of a water body. Blooms might be composed of undesirable species that are harmful to other aquatic life, possibly form nuisance scums on the water surface and create taste and odor in the drinking water supply. If algal populations are large enough, they can also reduce oxygen levels in the water column during algal die-off resulting in invertebrate and fish kills.

Severe bloom conditions generally occur when chlorophyll *a* concentrations exceed 60 ppb. Concentrations between 40 and 60 ppb are indicative of moderate bloom conditions. The occurrence and effects of these bloom conditions on the lake depend on a variety of factors. Persistence of bloom conditions over large areas may indicate increased nutrient concentrations.

Lake-wide chlorophyll *a* distributions for monitoring events during the fourth quarter in 2000 are presented in **Figures 7a** through **7c**. Chlorophyll *a* levels averaged 28.1 ppb in October, 10.63 ppb in November and 19.7 ppb in December. These average chlorophyll *a* levels were comparable to those reported for the same period in 1999.

In October, a moderate bloom condition was observed extending from Fisheating Bay on the western side of the lake (**Figure 7a**). Another moderate bloom was observed along the northwestern shores of the lake. These two bloom conditions covered approximately 23 percent of the lake’s surface water.

No bloom conditions were observed during November 2000 (**Figure 7b**). Chlorophyll *a* concentrations ranged from 3.1 to 31 ppb.

Although chlorophyll *a* concentrations increased by the December monitoring event, less than 1 percent of the lake exhibited bloom conditions (**Figure 7c**). A small moderate bloom was observed at the littoral shelf in the south. The highest chlorophyll *a* level recorded here was 49 ppb.

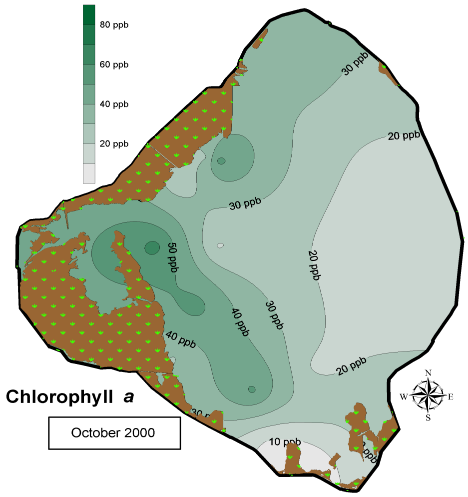


Figure 7a.
Chlorophyll *a* levels in Lake Okeechobee, October 2000

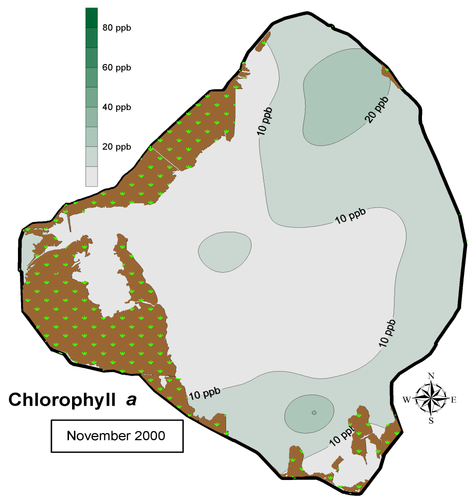


Figure 7b.
Chlorophyll *a* levels in Lake Okeechobee, November 2000

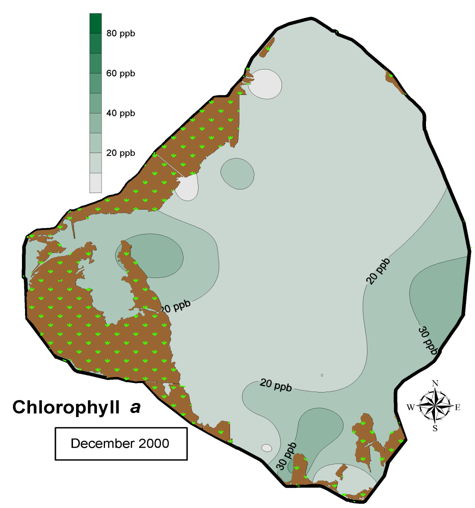


Figure 7c.
Chlorophyll *a* levels in Lake Okeechobee, December 2000

EVERGLADES AGRICULTURAL AREA

SUMMARY

MAP

Phosphorus Loading Trends

The Everglades Best Management Practices (BMP) Program (Rule 40-E, 63, Florida Administrative Code) for the Everglades Agricultural Area (EAA) requires that the EAA basin achieve a 25 percent reduction in total phosphorus (TP) load discharged to the Everglades. The reduction is determined by comparing phosphorus discharges at the end of each 12-month water year period (May 1 through April 30) with the pre-BMP base period of October 1, 1978, through September 30, 1988. The first full year of BMP implementation was water year 1996.

Rainfall recorded during the fourth quarter of 2000 was below the historical average (based on 30 years of data) for the EAA basin. Both November and December were extremely dry months with rainfall totaling 0.3 and 0.4 inches, respectively. Total rainfall for October was 5.8 inches which exceeded the historical average for the month. However, 95 percent of the total rainfall for the month was recorded during the first seven days of October when a subtropical disturbance passed through the area. Only 8.2 inches of rainfall were recorded in the EAA Basin during the fourth quarter of 2000.

During the fourth quarter, approximately 40,000 acre-feet of lake water entered the EAA canals through S351 and S354, combined. In contrast, approximately 184,000 acre-feet of water were discharged from the EAA to the Water Conservation Areas (WCAs) via pump stations S6, S7 and S8. Of this total, 154,000 acre-feet were released only in October 2000 as a result of the rainfall from the subtropical disturbance. Monthly total phosphorous loads from the EAA Basin for the fourth quarter varied with rainfall. More than 99 percent of the TP load for the quarter occurred in October. (**Figure 8**). The total load for the quarter was 55.5 metric tons, approximately 12 percent lower than the load for the corresponding quarter in 1999.

District pump stations S5A, S6, S7, S150, and S8 (see map) convey a majority of the water from the EAA to the WCAs. Total phosphorus loads and flows measured at these pump stations are presented in **Figure 9.** In addition, flow-weighted mean total phosphorus concentrations in water released from these stations to the WCAs are presented in **Figure 10**.

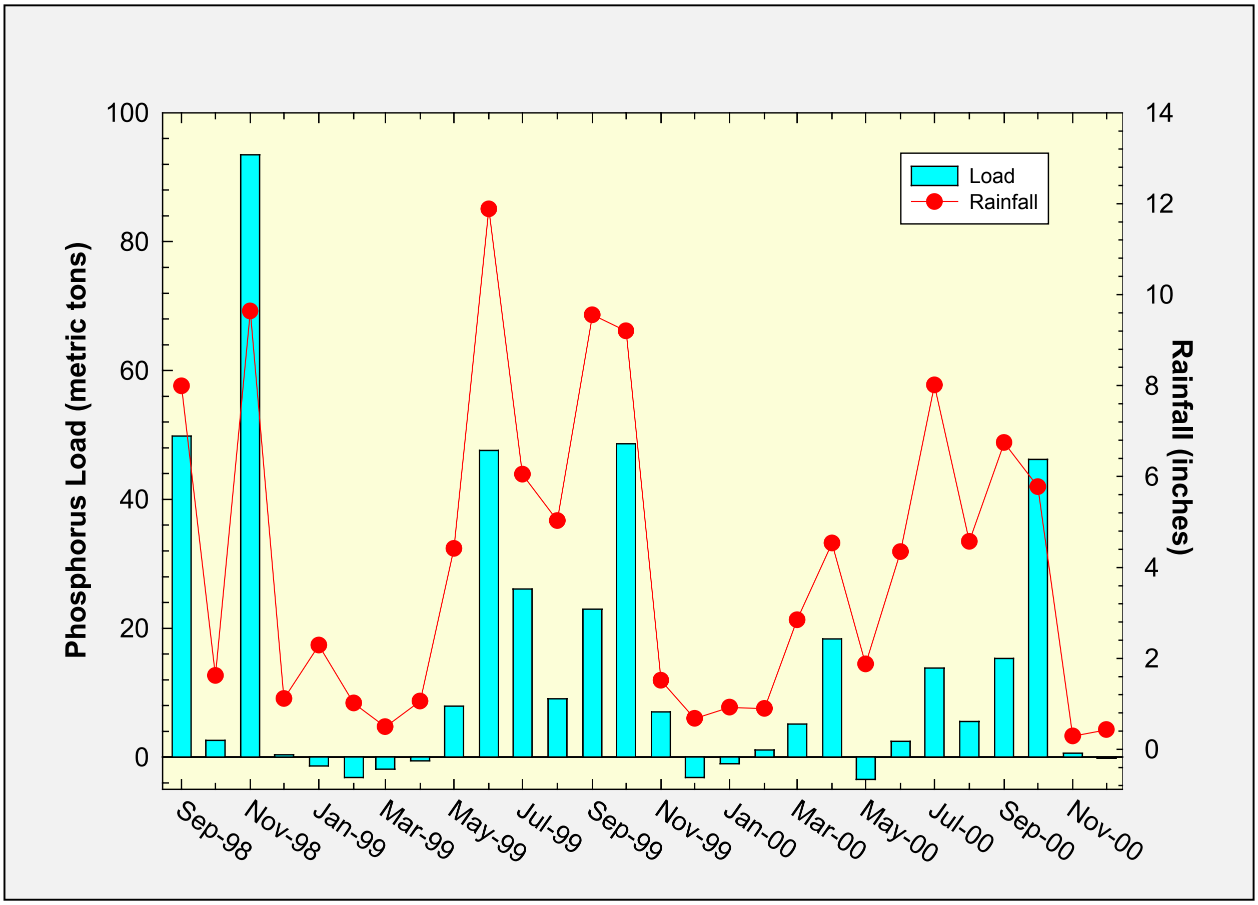


Figure 8. Monthly phosphorus loads calculated for the EAA Basin and monthly rainfall for the EAA.

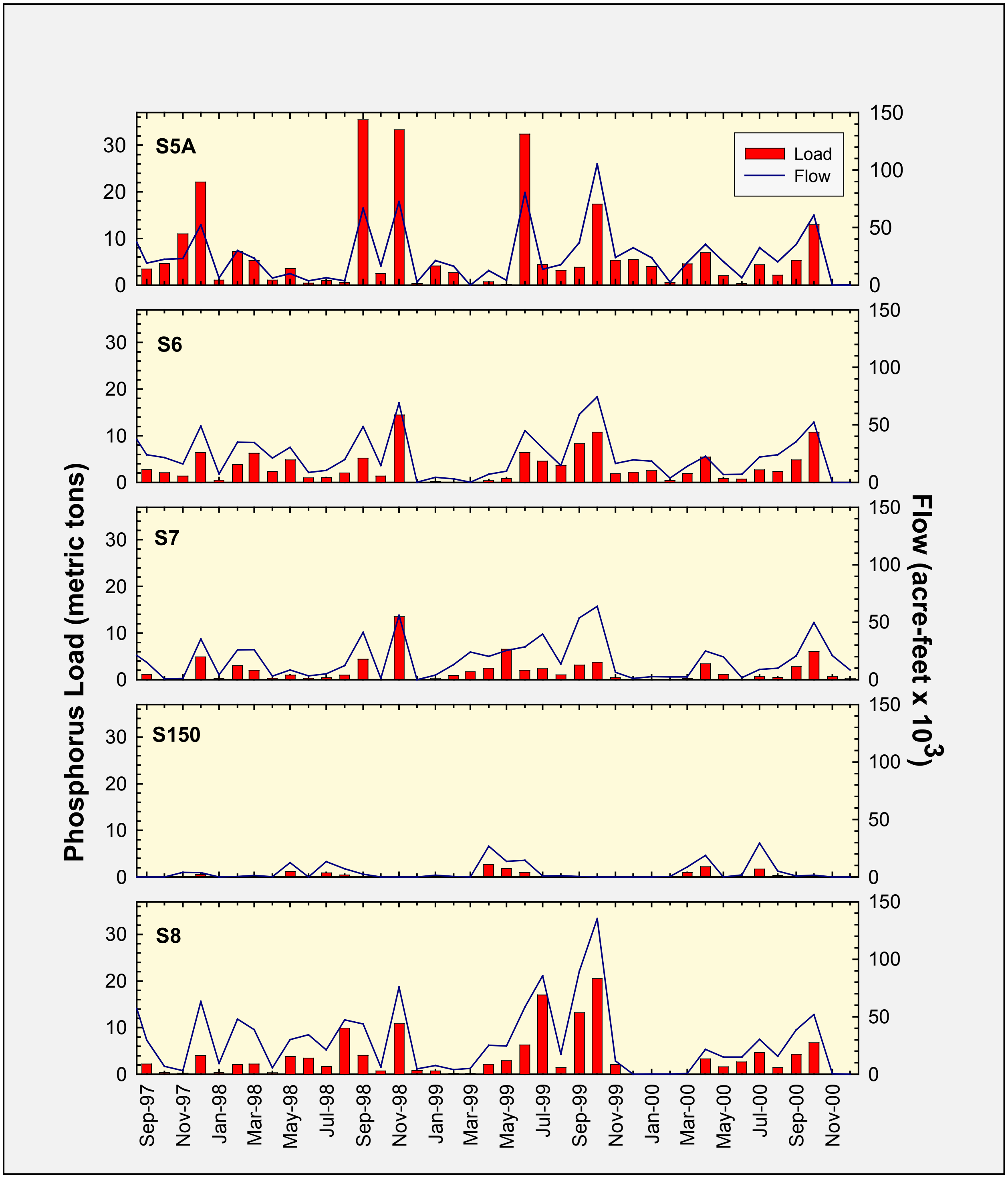


Figure 9. Monthly flows and calculated phosphorus loads at major EAA pump stations.

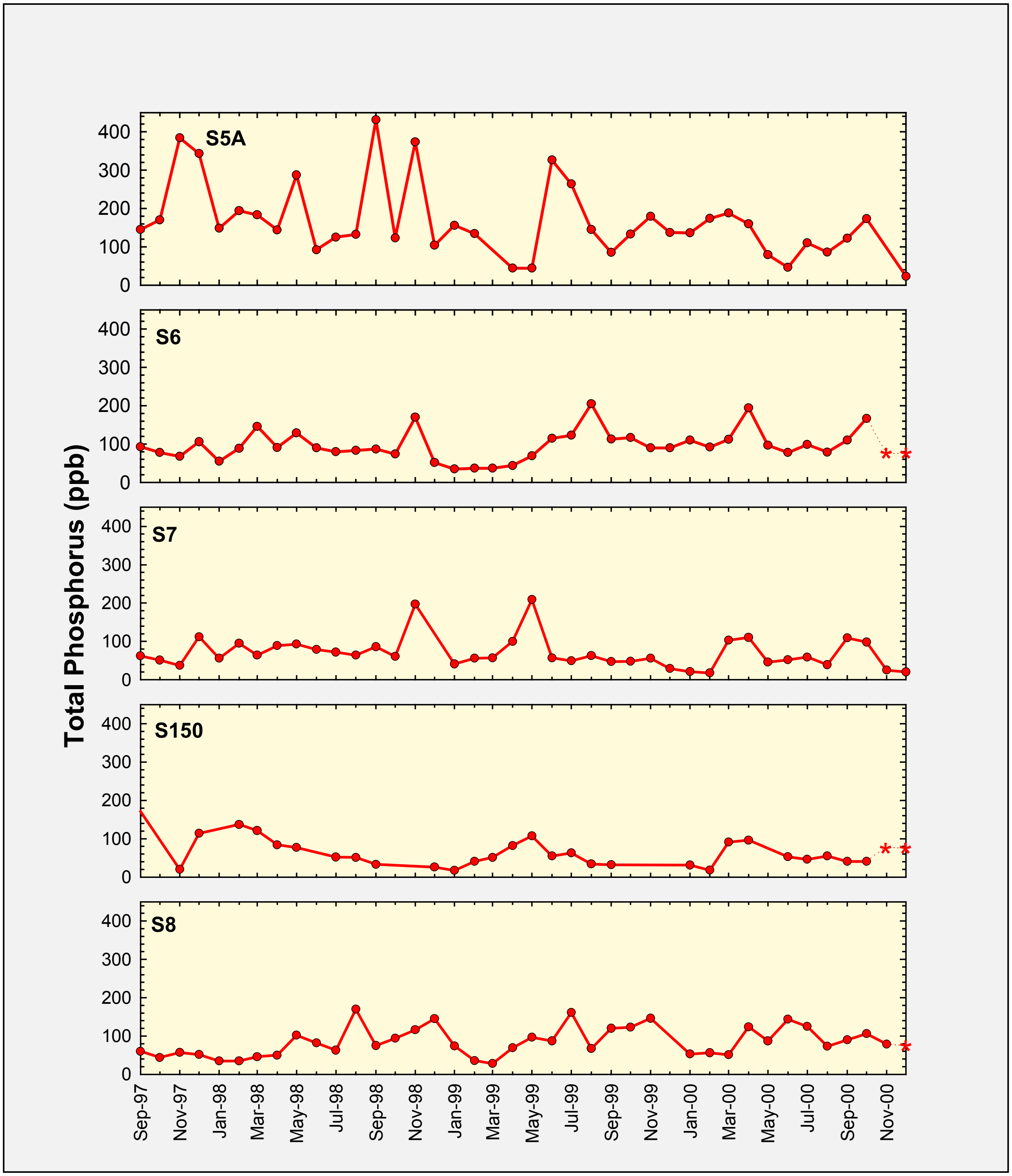


Figure 10. Monthly flow-weighted mean total phosphorus concentrations at major EAA pump stations (*flow-weighted mean can not be determined when flow is zero)

A summary of monthly flows measured at each structure during the third quarter of 2000 is presented in **Table 3**. Total phosphorus loads for each structure are summarized in **Table 4**. Flow-weighted mean total phosphorus concentrations are presented in **Table 5**.

Table 3. EAA Pump Station Flows (k-acft)

	Oct-00	Nov-00	Dec-00
S5	60.8	0.0	35.3
S6	52.4	0.0	35.3
S7	49.7	20.9	20.7
S150	1.5	0.0	0.8
S8	51.9	0.4	38.7
Sum	**216.3**	**21.3**	**130.8**

Table 4. EAA Pump Station TP Loads (metric tons/month)

	Oct-00	Nov-00	Dec-00
S5	13.0	0.0	6.3
S6	10.8	0.0	4.8
S7	6.0	0.6	2.8
S150	0.1	0.0	0.0
S8	6.8	0.0	4.3
Sum	**36.6**	**0.7**	**18.2**

Table 5. EAA Pump Station Flow-weighted Mean TP Concentrations (ppb)

	Oct-00	Nov-00	Dec-00
S5	173	----	23
S6	167	----	----
S7	98	25	20
S150	41	----	----
S8	106	79	----

Dashed lines in Table 5 indicate that flow-weighted TP concentrations cannot be determined when flow is zero.

STORMWATER TREATMENT AREAS

STORMWATER TREATMENT AREA 1 WEST

SUMMARY

MAP

Background

Stormwater Treatment Area 1 West (STA-1W) encompasses the four treatment cells of the Everglades Nutrient Removal Project (ENR) plus the newly constructed treatment Cell 5 creating a total effective treatment area of 6,870 acres. The permit for the ENR expired at the end of April 1999. The STA-1W permit went into effect May 11, 1999. Cell 5 passed the start-up phase of operation for both phosphorus and mercury during the week of January 17, 2000.

In accordance with construction plans, the inflows to STA-1W were diverted July 12, 1999, from pump station G-250 to inflow structure G-302, a component of the new Inflow and Distribution Works for STAs-1W and 1E. As a result of the diversion, pump station S5A became the inflow monitoring station for STA-1W. The outflow site (G251) from the ENR permit remains the same for the STA1W. A new outflow pump station, G310, began operation on July 5, 2000, predominantly discharging flow from Cell 5.

Phosphorus Loads and Concentrations

Total phosphorus loads for STA-1W were reduced by 88 percent in October Load reductions for November and December could not be calculated due to no inflows (**Figure 11A**). During October 12.9 metric tons of total phosphorus entered STA-1W through S5A compared to 0.2 and 63 metric tons discharged from G251 and G-310, respectively (**Figure 11B**).

The October average flow-weighted (FWM) total phosphorus concentration for S5A was 187. ppb (**Figure 12**). The flow-weighted mean concentrations in the outflows in October were 20 ppb for G-251 and 82 ppb for G310. G-310 had a 28 ppb flow-weighted mean discharge concentrations for November.

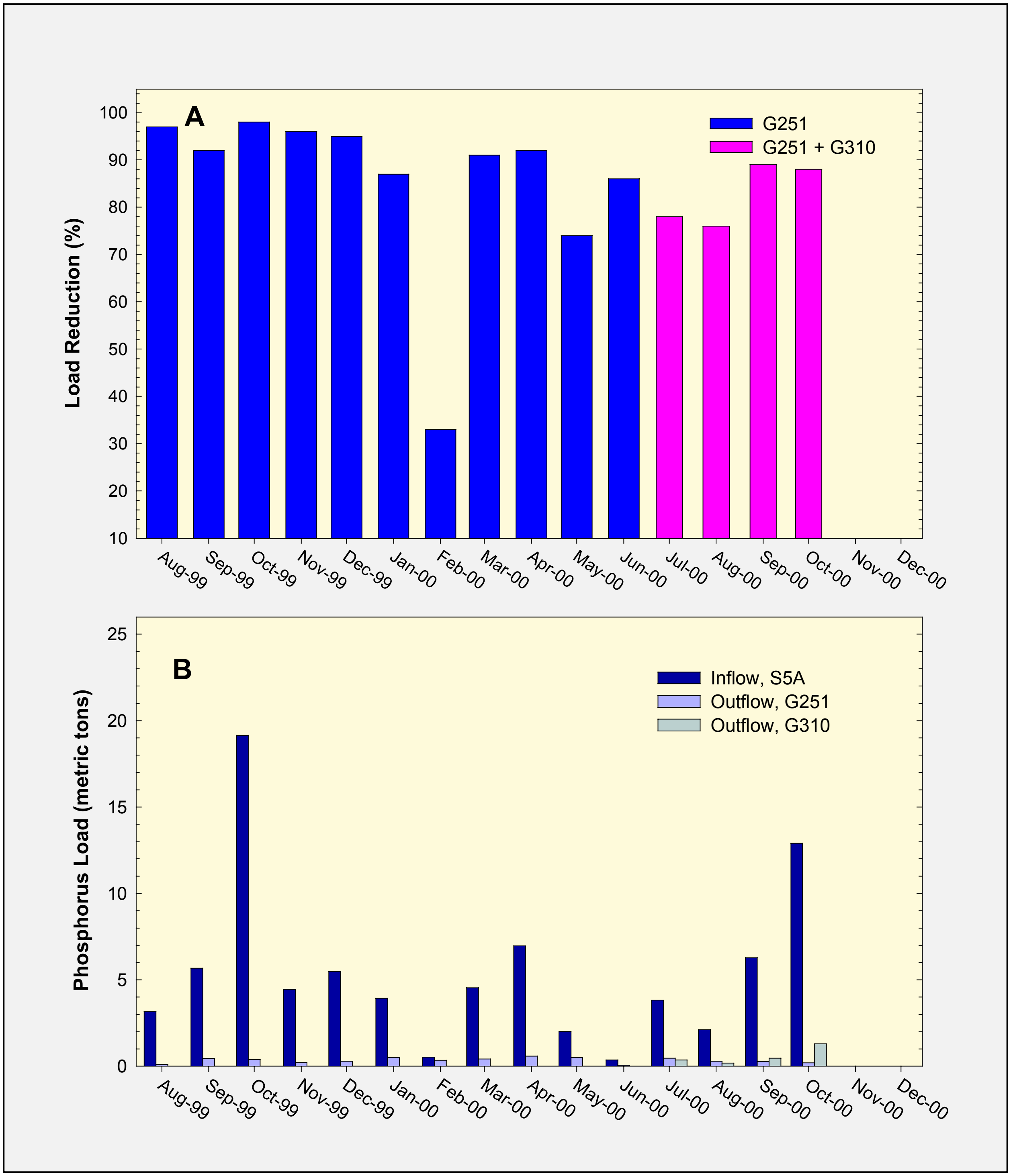


Figure 11. a. Monthly percent reduction of total phosphorus in STA-1W.
b. Monthly total phosphorus loads at inflow and outflow sites of STA-1W.

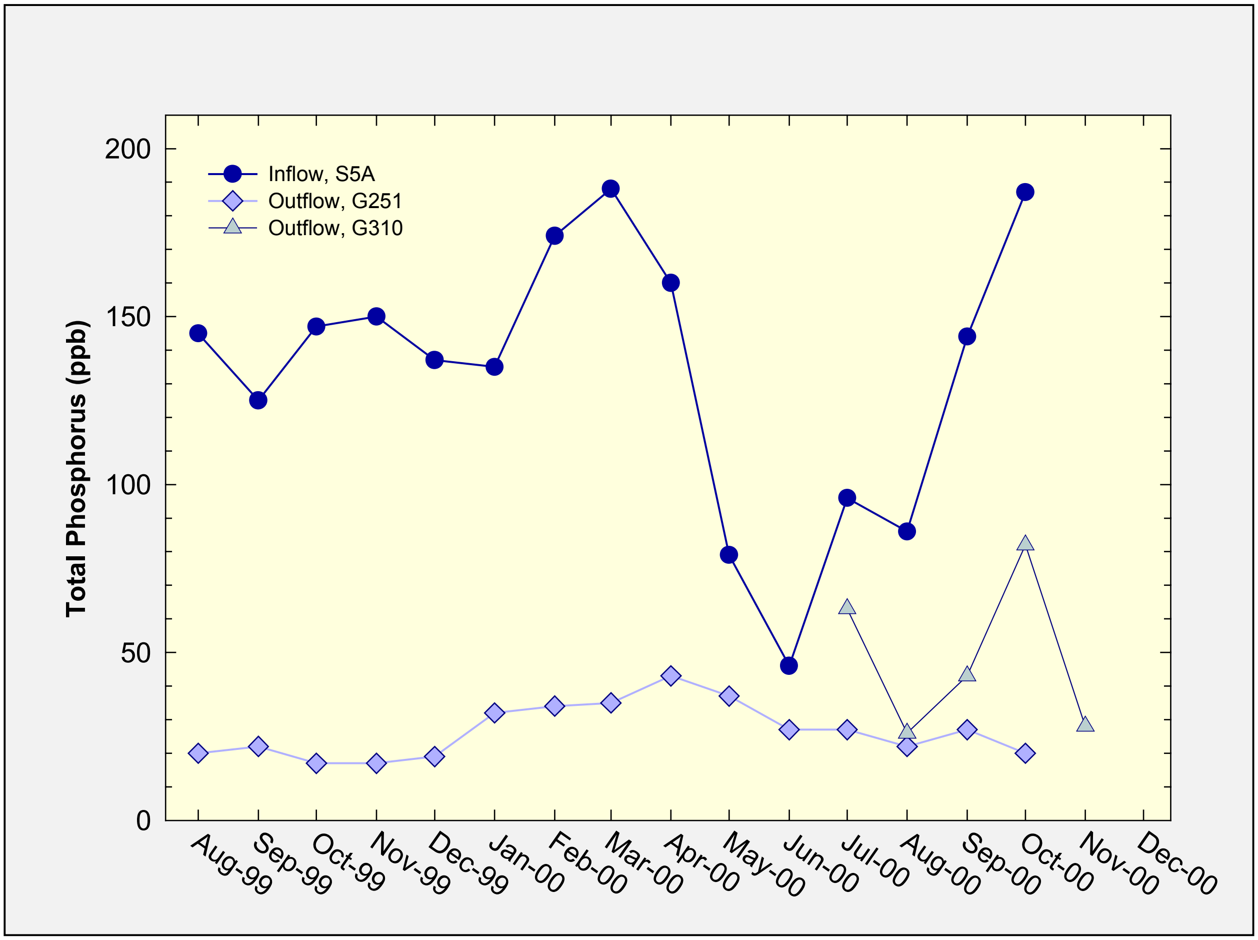


Figure 12. Monthly flow-weighted mean total phosphorus concentrations at inflow and outflow sites of STA-1W.

Mercury Monitoring

The STA permits require the District to collect unfiltered water samples quarterly at inflows and outflows for analysis of total mercury (THg) and methylmercury (MeHg). The permits also require the District to collect between 100 and 250 mosquitofish *(Gambusia holbrooki*) semiannually and 20 largemouth bass *(Micropterus salmoide*s) annually from the inflow, interior marshes and outflows for mercury analysis. Individual mosquitofish are pooled to form composite samples for each location. In 2000, sunfish *(Lepomis spp.)* were added to this monitoring program to better evaluate mercury exposure to fish-eating birds. Monitoring mercury concentrations in aquatic animals provides several advantages. First, MeHg occurs at much greater concentrations in biota (animal and plant life) relative to surrounding water, making chemical analysis more accurate and precise. Although detection levels of part per trillion (ppt or ng/L) have been achieved for total mercury and methylmercury in water, uncertainty boundaries can become large when ambient concentrations are very low, as is often the case in the Everglades. Second, organisms integrate exposure to mercury over space and time. Since mosquitofish are short-lived, they can be used to monitor short-term changes in environmental concentrations of mercury through time. Largemouth bass and sunfish are long-lived species and represent average conditions that occurred over previous years. Finally, the mercury concentration in biota is a true measure of MeHg bioavailability and is therefore a better indicator of possible mercury exposure to fish-eating wildlife than the aqueous concentration of mercury in surface water.

Mercury Levels STA-1W

Routine monitoring of mercury concentrations at STA-1W began February 16, 2000. Surface water samples for the third quarter of 2000 were collected August 22. At that time, construction of the second outflow pump, G310, had been completed. Total mercury concentration was 2.6 ng/L at the inflow and 2.3 ng/L at the two outflows (G251 and G310). While concentrations of total mercury were slightly elevated compared to the first two quarters (**Figure 13a**), they were within the typical range previously measured in this area when it was operated as the Everglades Nutrient Removal Project. Total mercury concentrations were lower at the outflows compared to the inflow and were below Florida's Class III Water Quality Standard of 12 ng/L. Methylmercury concentration was 0.46 ng/L at the inflow and 0.61 (G251) and 0.12 (G310) ng/L at the two outflows (**Figure 13b**). Methylmercury concentration at the G251 outflow was greater than the concentration observed at the inflow and was at the extreme range of levels previously measured during operation of the ENR project. While the level of methylmercury at G251 warrants continued scrutiny, it does not represent an anomalously high

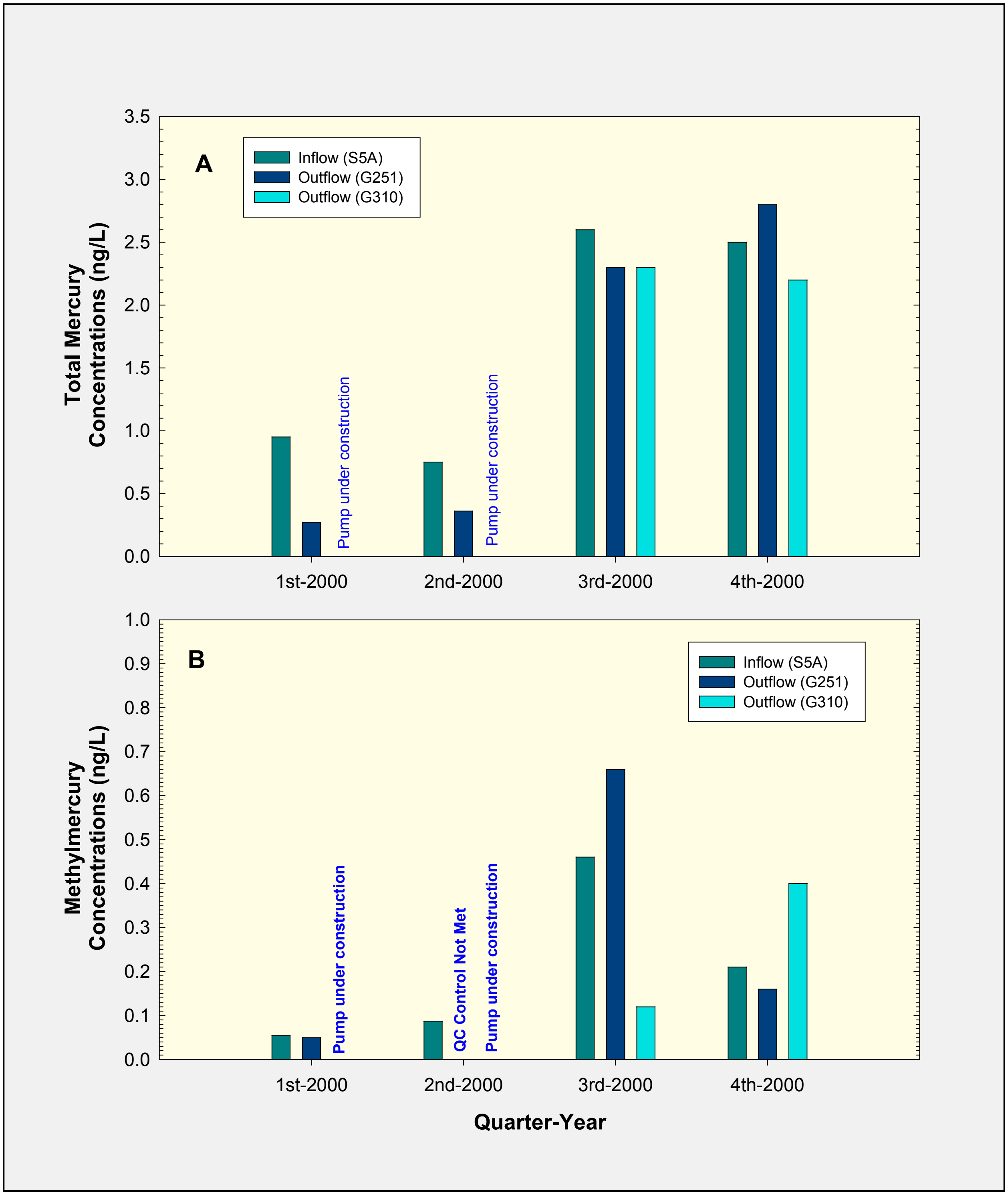


Figure 13. **a.** Quarterly surface water total mercury concentrations at inflow and outflow sites of STA-1W. **b.** Quarterly surface water methylmercury concentrations at inflow and outflow sites of STA-1W.

value when compared to concentrations observed at other locations in south Florida, including other STAs.

Results from the annual collections of largemouth bass and sunfish are reported in the *2001 Everglades Consolidated Report* (SFWMD, 2001). Results from the first semiannual collection of mosquitofish (**Figure 14**), were first reported in the October 2000 Environmental Conditions Update Report. As previously stated, concentrations of mercury in fish tissues were well below guidance levels suggested by both the U.S. Fish and Wildlife Service (USFWS; 100 ng/g) and the U.S. Environmental Protection Agency (U.S. EPA; 77 ng/g) for the protection of fish-eating avian and mammalian wildlife.

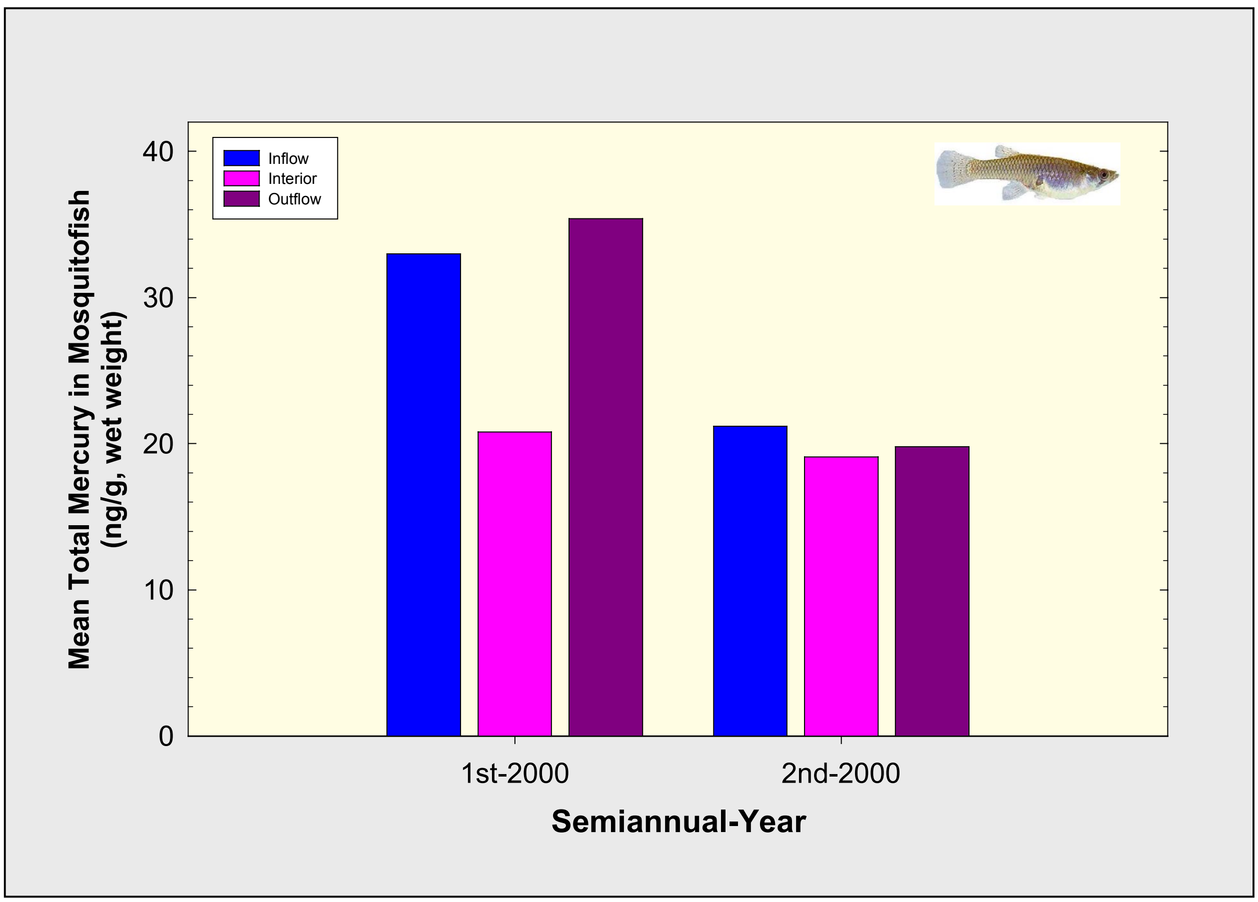


Figure 14. Mean total mercury concentrations in mosquitofish collected at the inflow, interior and outflow of STA-1W.

STORMWATER TREATMENT AREA 5

SUMMARY

MAP

Background

Stormwater Treatment Area 5 (STA-5) began flow-through operation on July 7, 2000. STA-5 has an approximate treatment area of 4,118 acres, which was previously agricultural cropland. STA-5 receives untreated runoff from the C-139 Basin via the L2 canal and discharges treated water to the Miami Canal.

Phosphorus Concentrations

For October 2000, the flow-weighted mean total phosphorus concentration at the four inflow sites (G-342A-D) averaged 323 ppb. For November the concentration was 88 ppb. At the four outflow sites (G-344A-D) the flow-weighted mean averaged 81 ppb for October. The November outflow-weighted mean and the inflow and outflow-weighted means for December could not be calculated due to negligible flows (**Figures 15**).

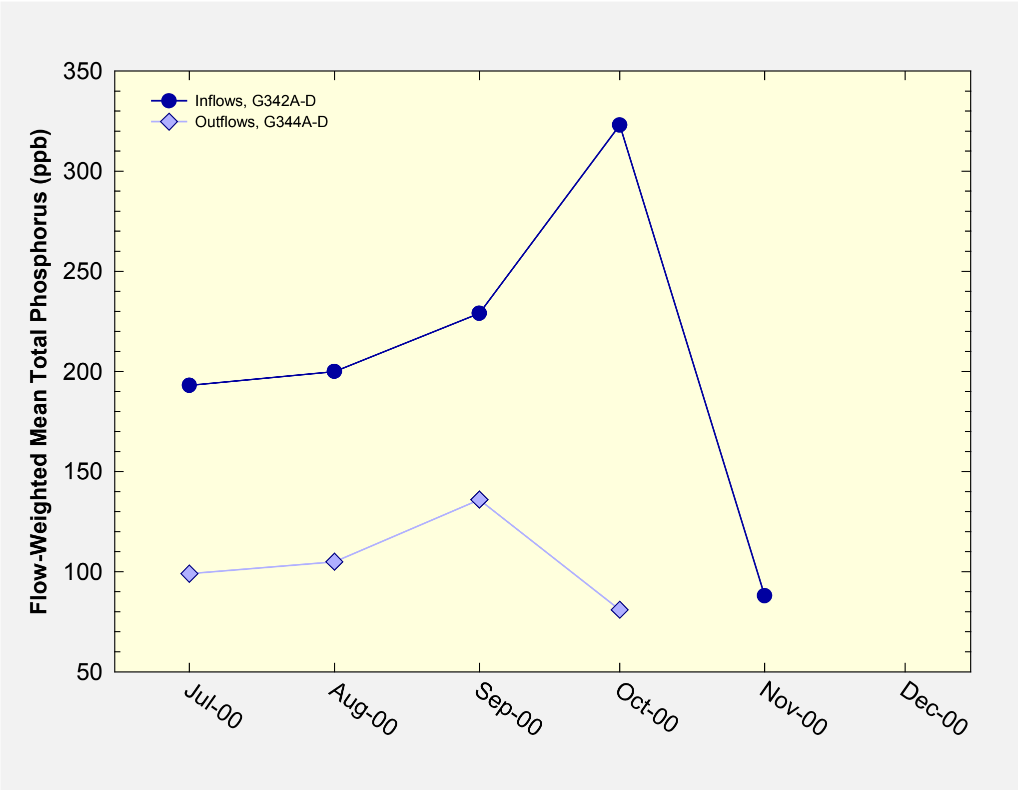


Figure 15. Monthly flow-weighted mean total phosphorus concentrations at inflow and outflow sites of STA-5.

Phosphorus Loads

The October total phosphorus inflow and outflow loads for STA-5 were 5.5 and 29 metric tons, respectively., resulting in a 47 percent load reduction (**Figure 16a**). The total phosphorus inflow load was 0.1 metric tons for November. The outflow load for November and the inflow and outflow loads for December could not be calculated due to negligible flows (**Figure 16b**).

Mercury Levels STA-5

Routine monitoring of mercury levels at STA-5 began during the first quarter of 2000. Surface water samples for the fourth quarter of 2000 were collected on December 13. At that time, average THg concentration was 1.03 ±0.1 at the four inflows and 2.4 ±1.3 ng/L at the four outflows (**Figure 17a**). (average ±1 standard deviation; s*tandard deviation measures the variability or dispersion of data around the mean. A small standard deviation implies that the data are clustered around the mean. For a normal distribution, about 95 percent of the observations should lie within two standard deviations of the mean*). Methylmercury (MeHg) concentration at the inflows and outflows were 0.5 ±0.3 and 1.5 ±1.1 ng/L, respectively (**Figure 17b**). Both THg and MeHg were at greater concentration in the outflows compared to the inflows. Elevated levels centered near discharge culverts G344A and G344B from Treatment Train 1. As will be discussed below, mosquitofish from this treatment train also contained higher levels of THg relative to mosquitofish collected elsewhere. Nevertheless, THg concentration remained below the Class III Water Quality Standard of 12 ng/L.

The first semi-annual collection of mosquitofish occurred in March of 2000. The second semi-annual collection occurred on Setempter 7. At that time, average tissue mercury concentration was 35.5 ±9.1 ng/g (on a wet weight basis) in mosquitofish collected near the inflows, 97 ±40.9 ng/g in mosquitofish from interior marshes and, 47.9 ±4.9 ng/g in mosquitofish from the Discharge Canal near the outflows (**Figure 18**). As mentioned above, mercury levels were highest in mosquitofish from Cell 1 (126 ng/g), which also exhibited elevated surface water concentrations. Concentration of mercury in mosquitofish from Cell 1 exceeded guidance levels suggested by both the U.S. Fish and Wildlife Service (USFWS; 100 ng/g) and the U.S. Environmental Protection Agency (U.S. EPA; 77 ng/g) for the protection of fish eating avian and mammalian wildlife. The factor or factors that lead to these spatial differences are as-yet

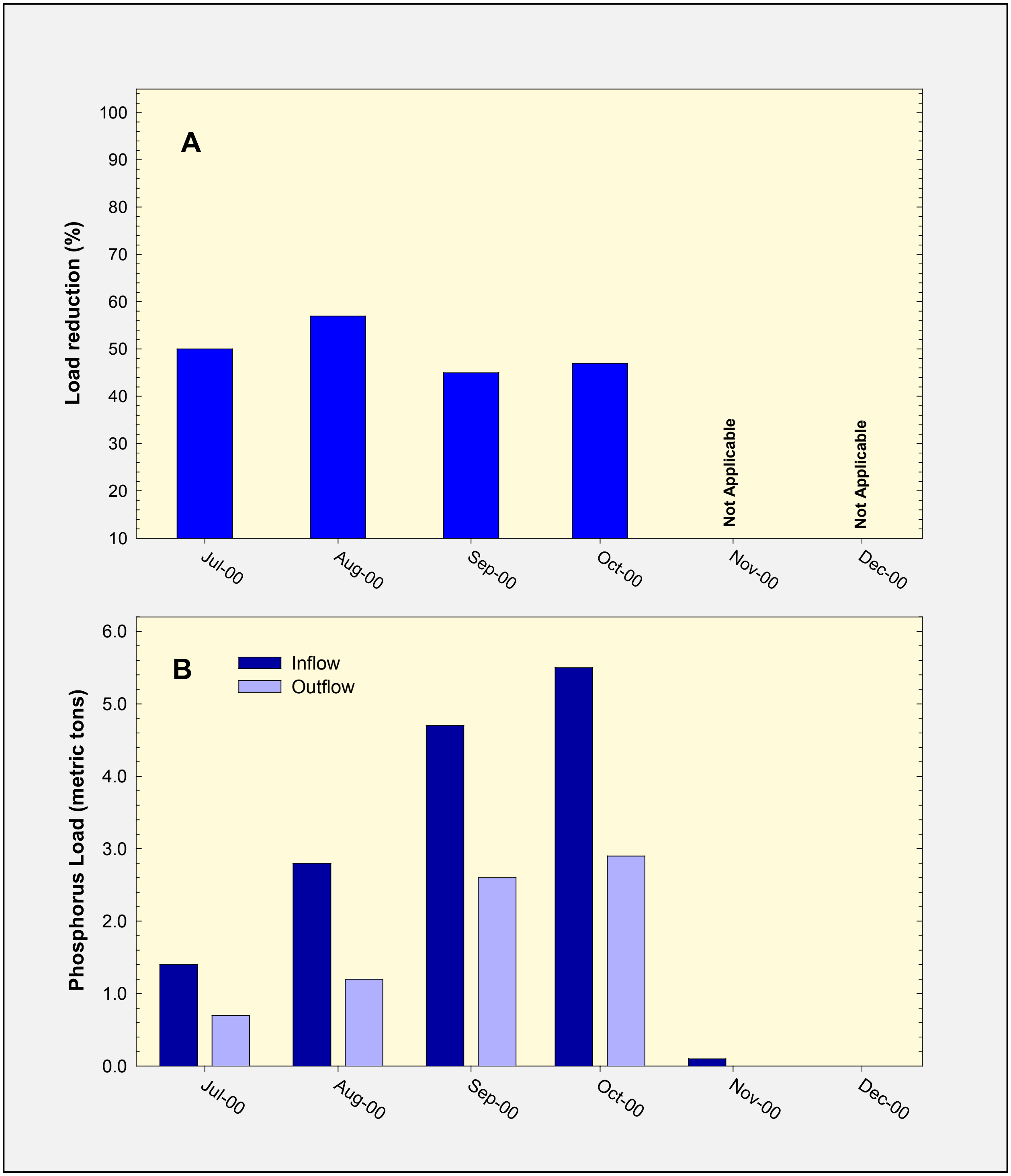


Figure 16. **a.** Monthly percent reduction of total phosphorus in STA-5.
b. Monthly total phosphorus loads at inflow and outflow sites of STA-5.

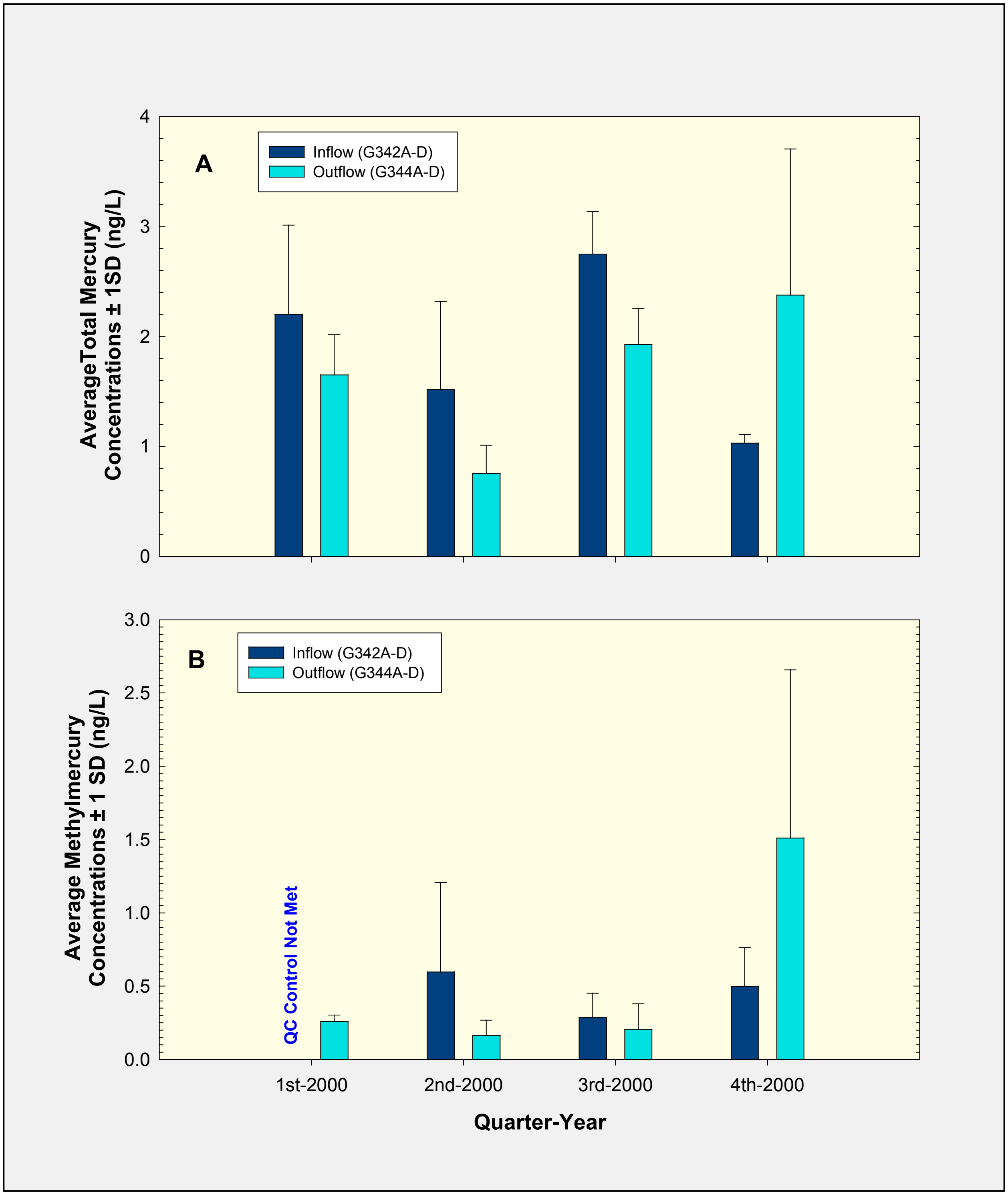


Figure 17. **a.** Quarterly surface water total mercury concentrations at inflow and outflow sites of STA-5. **b.** Quarterly surface water methylmercury concentrations at infow and outflow sites of STA-5. (Error bars depict one standard deviation around the mean.)

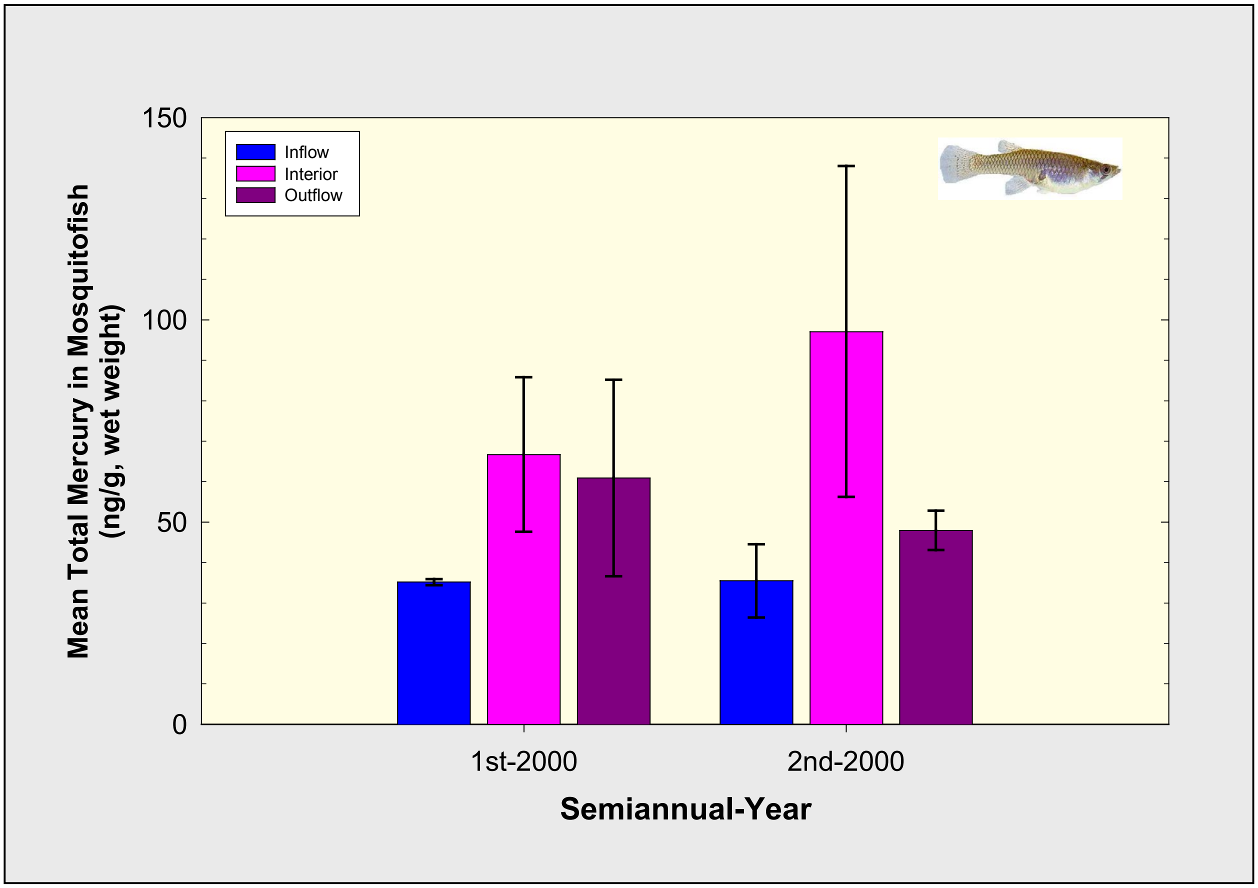


Figure 18. Mean total mercury concentrations in mosquitofish collected at the inflow, Interior and outflow of STA-5. (Error bars depict standard deviation around the mean.)

unknown. However, it important to note that mosquitfish in the discharge canal contained relatively low levels despite the elevated MeHg in surface water discharges. Local bioaccumulation of mercury is primarily determined by *in situ* methylation and biomagnificantion of MeHg up the food chain rather than by inputs of MeHg dissolved in the water column.

For more information about STA mercury monitoring permit requirements, please click here.

STORMWATER TREATMENT AREA 6

SUMMARY

MAP

Background

Stormwater Treatment Area 6 (STA-6), Section 1, began full operation December 9, 1997. It occupies an existing detention area associated with United States Sugar Corp.'s (USSC) Southern Division Ranch, Unit 2 development, except for 1 acre that is within the adjacent Rotenberger Tract. STA-6 provides a total effective treatment area of approximately 870 acres. The source of water for STA-6 comes solely from USSC's Unit 2 pump station G600.

Phosphorus Concentrations

For the fourth quarter of 2000, the flow-weighted mean total phosphorus concentrations at the inflow averaged 119 ppb and 32 ppb at the outflow (October and November only). The average flow-weighted mean total phosphorus concentration for the period of record at the outflow is 21 ppb, or 3 times lower then the average inflow concentration (**Figure 19a**).

Phosphorus Loads

Loads from the fourth quarter of 2000 were 3.8 metric tons at the inflow, and 0.4 metric tons at the outflow (October and November only) (**Figure 19b**). The total phosphorus load reduction for the fourth quarter of 2000 was 89 percent. The overall total phosphorus load has been reduced by 81 percent since the operation began.

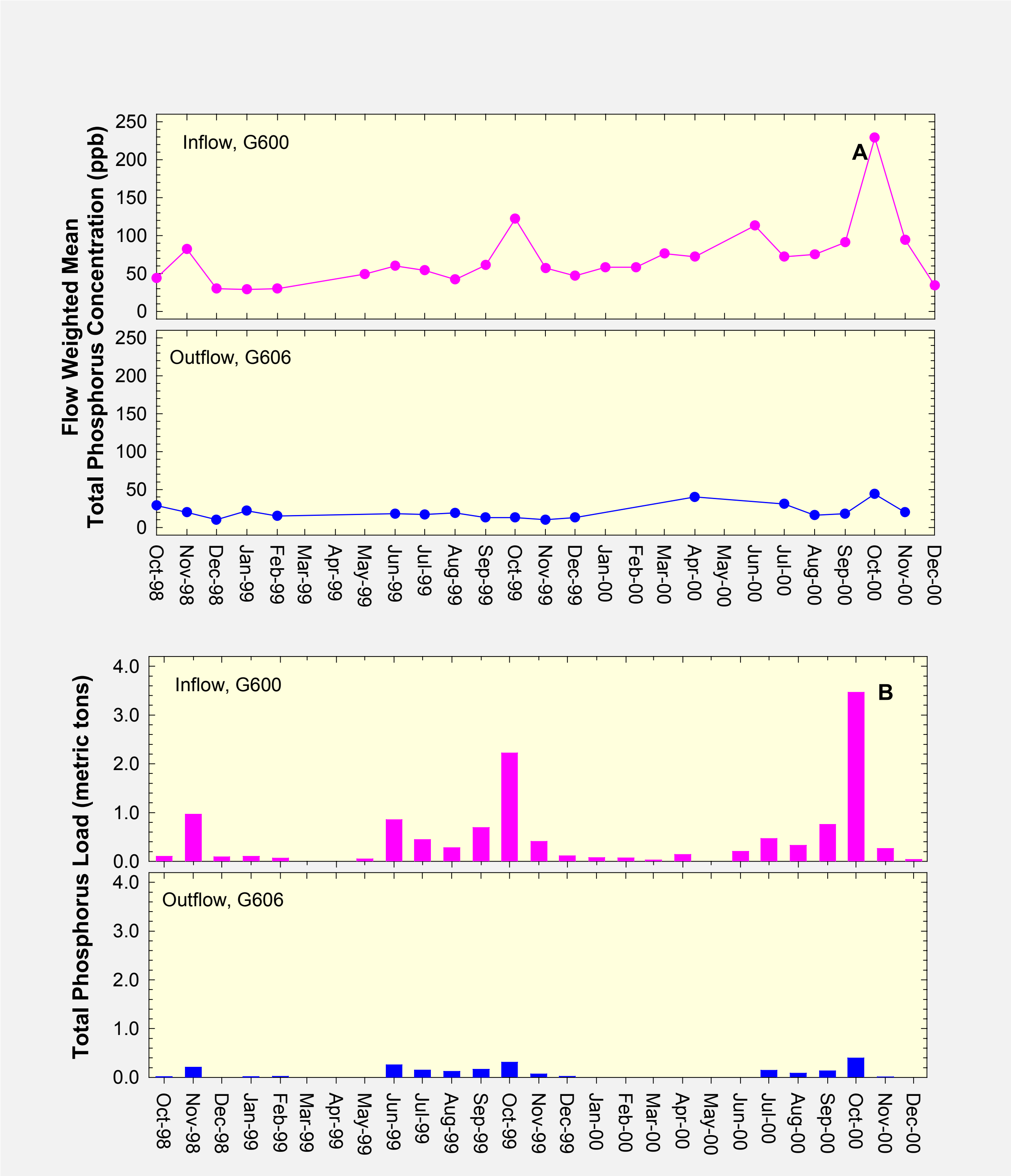


Figure 19. **a.** Weekly flow-weighted mean total phosphorus concentrations at inflow and outflow sites of STA-6, Section 1.
b. Monthly total phosphorus load at inflow and outflow sites of STA-6, Section 1.

Mercury Levels STA-6

Routine monitoring of mercury levels at STA 6 began in the first quarter of 1998. Surface water samples for the fourth quarter of 2000 were collected on December 6. At that time, THg concentrations at the inflow (G600) and the outflow (G606) were 2.6 and 2.3 ng/L, respectively (**Figure 20a**). Concentration of THg was greater at the inflow than the outflow. Moverover, concentrations of THg, both at the inflow and the outflow, remained below the Florida's Class III Water Quality Standard of 12 ng/L. MeHg concentrations at the inflow and the outflow were 0.25 and 0.43 ng/L, respectively (**Figure 20b**); however, the result for the outflow did not meet quality control criteria and, thus, is an estimate only. In addition to monitoring surface water at G606, samples were also collected at outflow culverts of each cell in December to examine spatial variability and representativeness of G606. Concentrations of THg were 2.3 ng/L and 2.0 ng/L at G393B and G354C, respectively. Concentrations of MeHg were 0.22 ng/L and 0.13 ng/L at G393B and G354C, respectively; however, the latter result again did not meet QC criteria. Nonetheless, it is clear that both THg and MeHg were at lower concentrations at the outflow culvert than in the Supply Canal (i.e., G600) or the Discharge Canal (i.e., G606).

Results from the annual collections of largemouth bass and sunfish are reported in the District's *2001 Everglades Consolidated Report, Chapter* 7. Mosquitofish were first collected at STA-6 in early 1998. Results from the first semi-annual collection of mosquitofish in 2000 (**Figure 21**), were first reported in the October 2000 Environmental Conditions Update Report. As previously stated, levels of mercury in mosquitofish from the inflow and outflow approached or just exceeded guidance levels suggested by the U.S. Fish and Wildlife Service (USFWS; 100 ng/g) and the U.S. Environmental Protection Agency (U.S. EPA; 77 ng/g) for the protection of fish-eating avian and mammalian wildlife. However, because there had been no appreciable discharge from STA 6 for six months, the mosquitofish in the Discharge Canal did not reflect flow from the STA and, thus, did not accurately reflect typical operation of the STA.

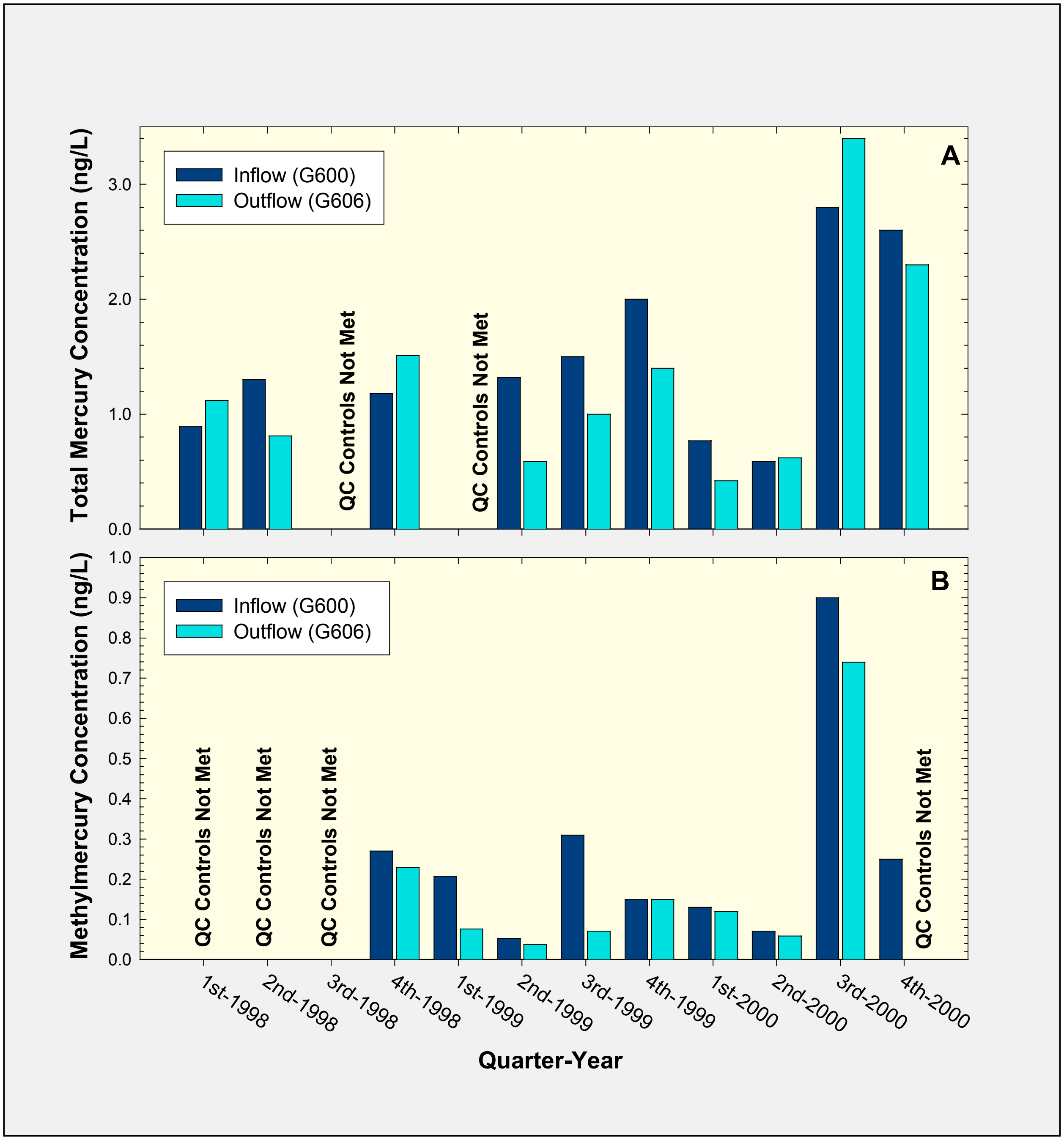


Figure 20. **a.** Quarterly surface water total mercury concentrations at inflow and outflow sites of STA-6. **b.** Quarterly surface water methylmercury concentrations inflow and outflow sites of STA-6.

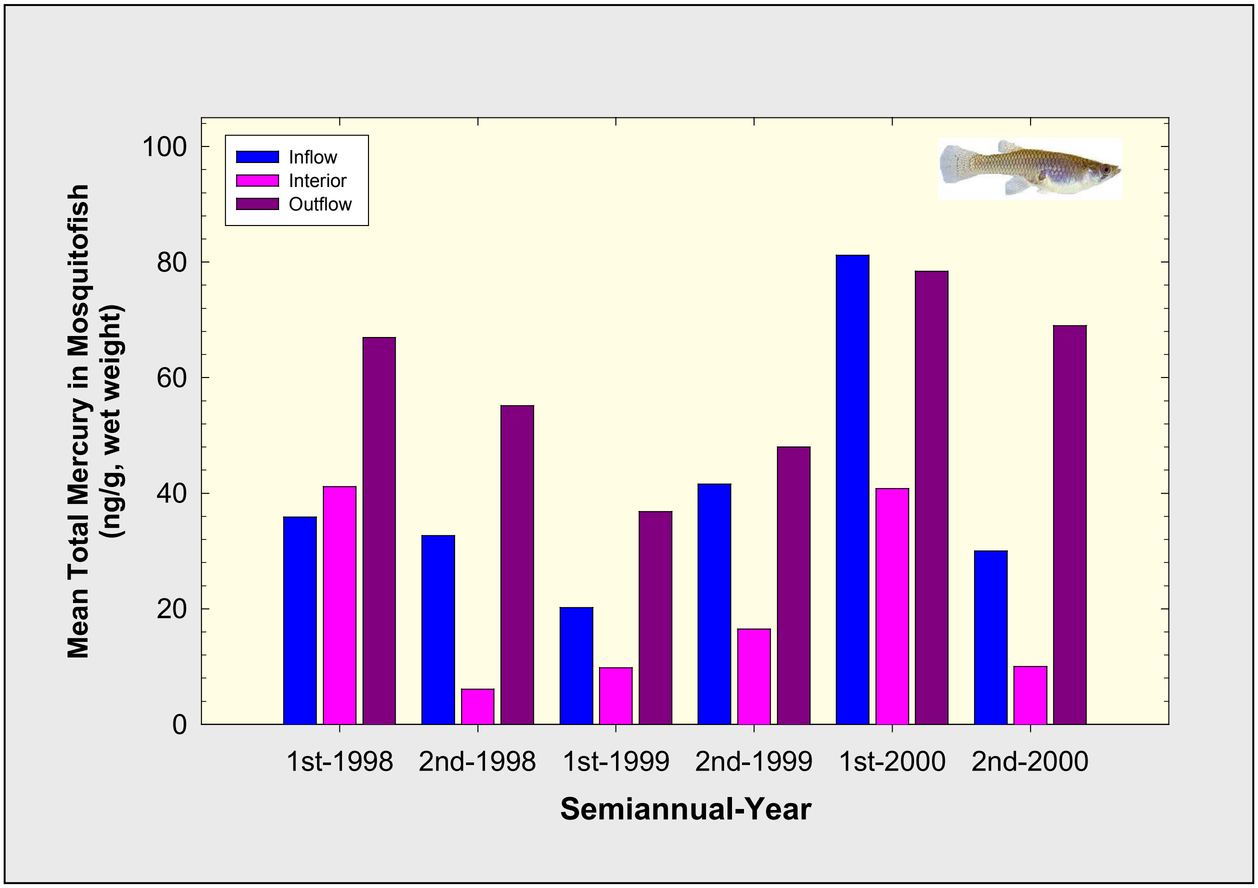


Figure 21. Mean total mercury concentrations in mosquitofish collected at the inflow, interior and outflow of STA-6.

HOLEY LAND

SUMMARY

MAP

The Holey Land Management Area (Holey Land) is a 35,000-acre tract of land that is operated as a wildlife management area by the Florida Fish and Wildlife Conservation Commission (FFWCC). A Memorandum of Agreement between the Florida Department of Environmental Protection (FDEP), the Board of Trustees of the Internal Improvement Trust Fund, the FFWCC and the South Florida Water Management District established an environmental restoration plan for the Holey Land. As part of the restoration plan, water quality monitoring was implemented to meet the requirements of FDEP Permit No. 06-500809209.

Water quality monitoring is conducted at six surface water inflow and outflow structures as shown in the map (click link above to view map). Nutrient inputs to the Holey Land can occur through surface water inflows from the Miami Canal (G200) and seepage return pumps (G200SD and G201).

Hydrology

The restoration effort also includes an operational schedule for maintaining surface water levels within the Holey Land. During the wet season from May 15 through October 31, the schedule rises linearly from approximately 10.5 feet National Geodetic Vertical Datum (NGVD) to 12 feet NGVD. During the dry season from November 1 through May 14, the schedule declines linearly from 12 feet NGVD to 10.5 feet NGVD. During wet years when sufficient rainfall can maintain the stage according to schedule, less surface water inflow from the Miami Canal is required. The restoration plan requires the outflow structures (G204, G205 and G206) to be closed. However, unregulated flows from the outflow structures occur through seepage.

Figure 22a demonstrates the relationship between rainfall, stage and inflows at G200 for the period from October 1997 through December 2000. In October 2000, a poorly organized subtropical disturbance passed through south Florida and deposited approximately 7.3 inches of rain in the Holey Land during the first week of the month.

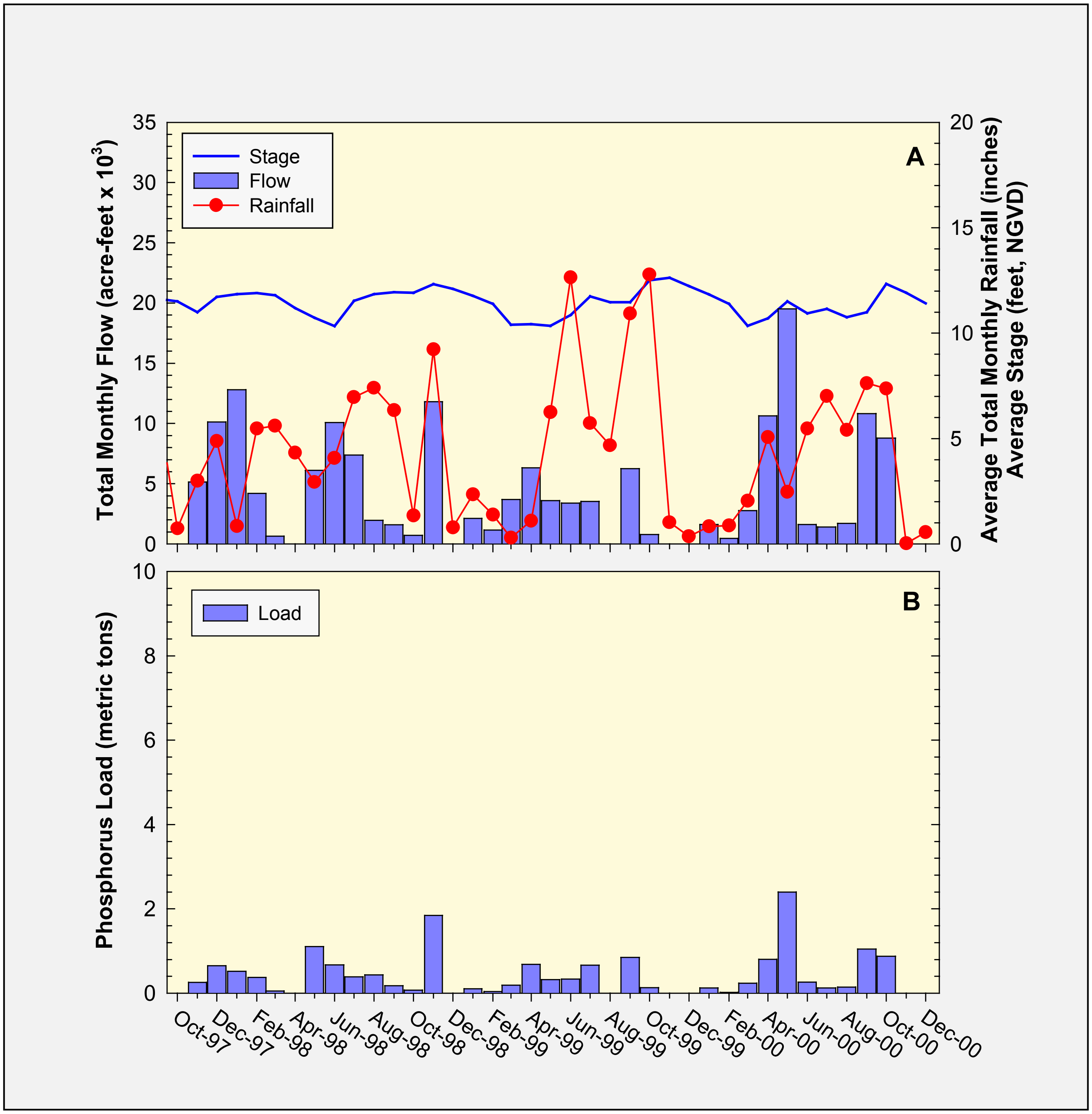


Figure 22. **a.** Flow, rainfall and stage measured at inflow station G200.
b. Phosphorus loads discharged into the Holey Land at inflow station G200.

Phosphorus Loads

Monthly phosphorus loads calculated for inflow site G200 are presented in **Figure 22b**. During the fourth quarter of 2000, 0.9 metric tons of phosphorus entered the Holey Land through G200. Phosphorus loads for October, November and December were 0.9, 0.001 and 0 metric tons, respectively. The highest phosphorus load for this period was observed in October and coincides with the high rainfall and resulting inflow from the subtropical disturbance.

The monthly load of phosphorus from October 1997 through December 2000 averaged approximately 0.4 metric tons. (**Figure 22b**). As a result of the rainfall from the October storm, approximately six times more phosphorus entered the Holey Land through G200 during the fourth quarter of 2000 than during the same period in 1999.

Phosphorus Concentrations

Figure 23 displays total phosphorus concentrations from October 1997 through December 2000 collected by grab and composite sampling at inflow station G200. Grab samples have been collected since July 1989, while composite samples have been collected since March 1996.

The total phosphorus concentration for grab samples collected at G200 from October 1997 through December 2000 averaged 63 parts per billion (ppb). In comparison, composite samples averaged of 79 ppb.

During the fourth quarter of 2000, total phosphorus concentrations averaged 57 ppb for grab samples and 65 ppb in composite samples.

Figure 24 provides the quarterly total phosphorus at concentration outflow stations G204, G205 and G206 collected by grab sample from 1997 through 2000. During the fourth quarter of 2000, no gradient in the total phosphorus concentration was evident for the three outflow stations. Historically, phosphorus concentrations at G204 and G205 have averaged approximately 62 ppb compared to 14 ppb at G206. The lower total phosphorus concentrations reported for G206 might result from dilution with water from the adjacent seepage canal where the phosphorus content is lower than in the management area. The canal water is pumped into the Holey Land from seepage return pump stations G200SD and G201. Total phosphorus concentrations measured at G201 and G200SD averaged 10 ppb and 15 ppb, respectively.

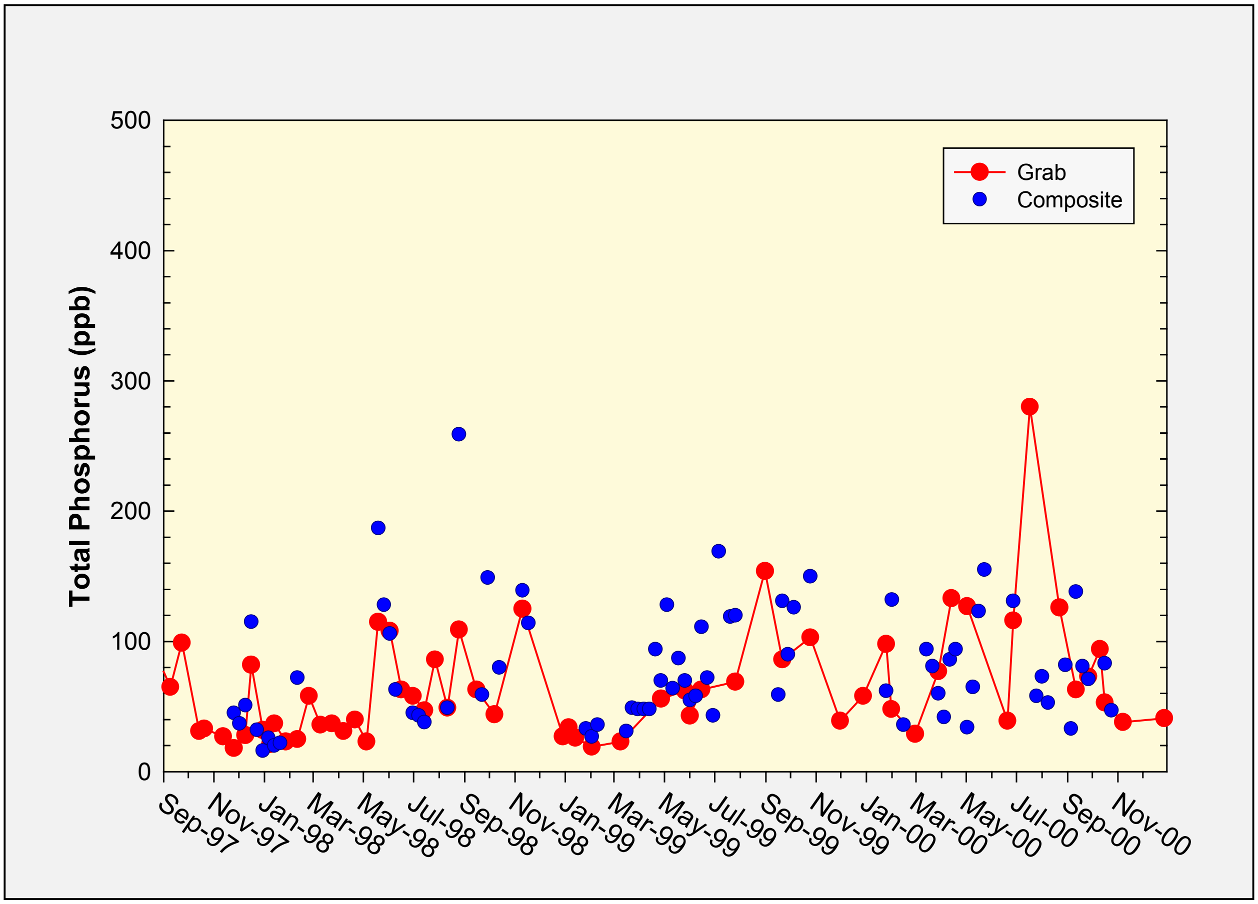


Figure 23. Total phosphorus concentrations form grab and composite samples collected at G200.

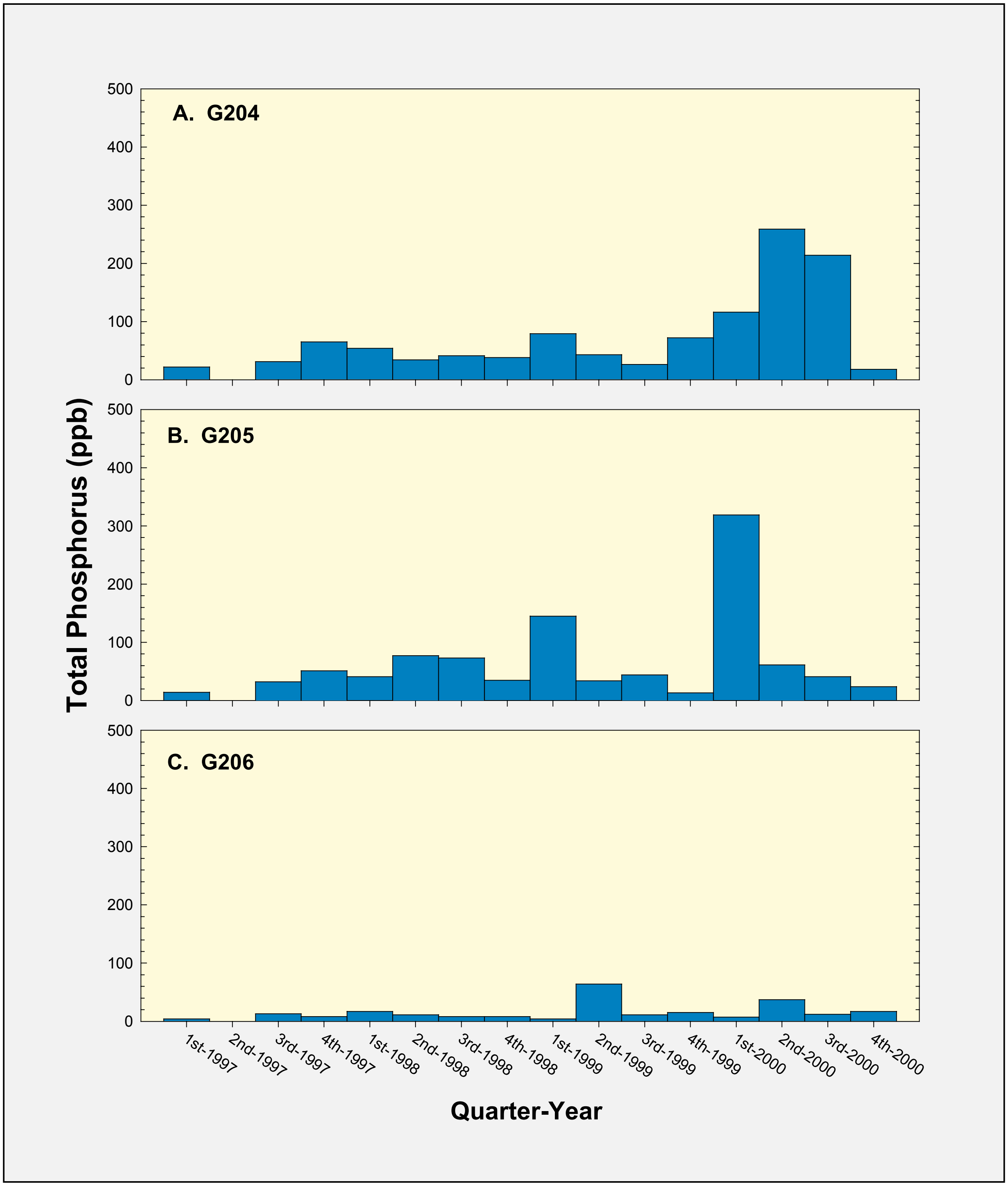


Figure 24. Quarterly total phosphorus concentrations measured for grab samples collected at outflow stations a. G204, b. G205 and c. G206.

ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE

SUMMARY

MAP

Phosphorus Concentrations

The Settlement Agreement entered into by the federal government, the State of Florida and the South Florida Water Management District in 1991 to end the Everglades lawsuit stipulates interim and long-term phosphorus concentration levels for the Loxahatchee National Wildlife Refuge (Refuge). The interim and long-term concentration levels must be met by Feb. 1, 1999, and Dec. 31, 2006, respectively. The concentration levels vary monthly because they are calculated as a function of water level measured at gaging stations 1-7, 1-8C and 1-9 within the Refuge. Total phosphorus concentrations are determined from water samples collected at the 14 interior marsh stations (LOX 3 through LOX 16) shown on the map.

Average stages in the Refuge were 17.49, 17.01 and 16.55 feet in October, November and December, respectively (**Figure 25**). The geometric means calculated from total phosphorus concentrations measured in water samples collected in October, November and December were 8.8, 7.5 and 6.0 ppb, respectively. The geometric mean concentration in October exceeded the calculated interim and long-term limits of 8.3 and 7.2 ppb, respectively (**Figure 25**). In November and December the geometric mean concentrations were lower than the interim and long-term limits (**Table 6**).

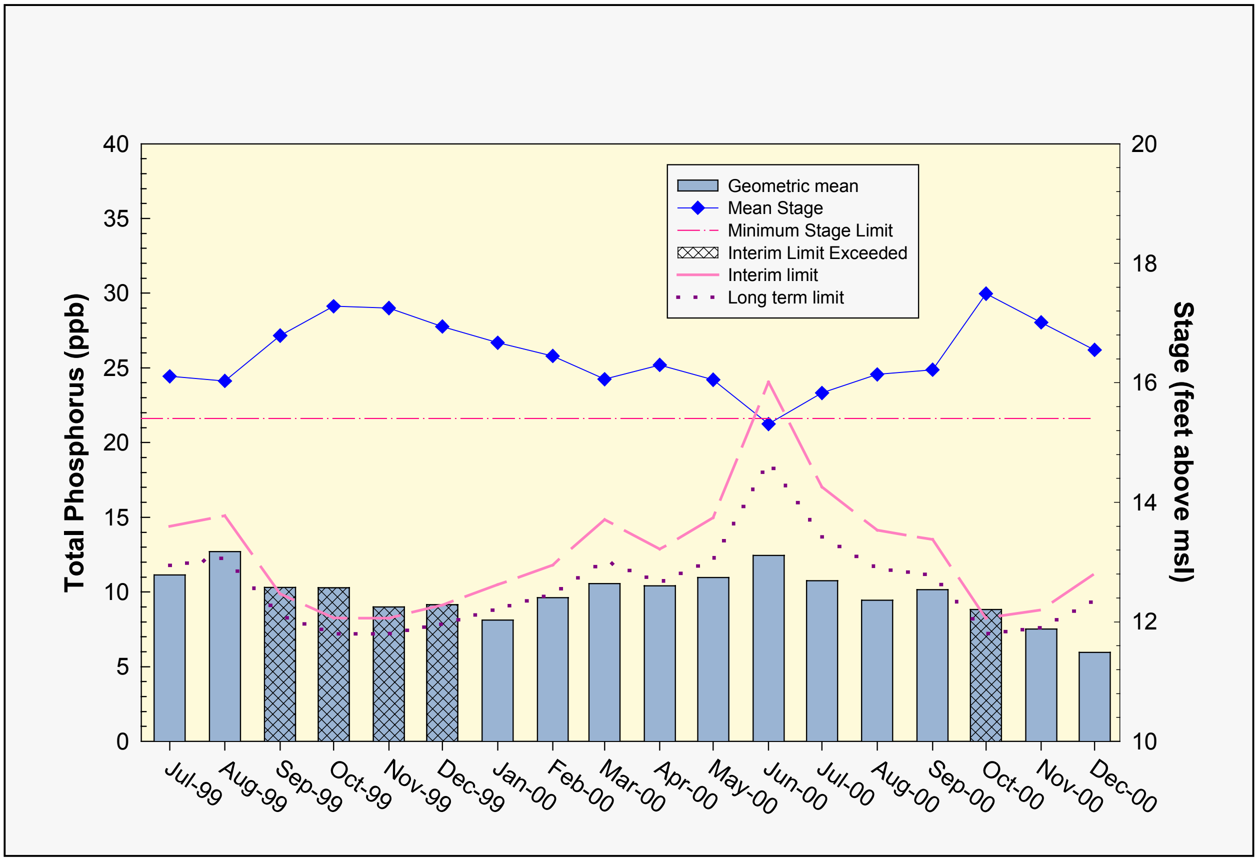


Figure 25. Monthly total phosphorus geometric mean concentration levels for the Loxahatchee National Wildlife Refuge compared to the interim and long-term targets. The calculated target concentrations are adjusted for fluctuations in water level.

Table 6. Loxahatchee National Wildlife Refuge Total Phosphorus Compliance.

Month and Year	Geometric Mean	Interim Limit	Long Term Limit	Average Stage	Number of Phosphorus Samples	Number of Stage Measurements
	(ppb)			(ft, NGVD)		
Jan-1999	6.9	8.8	7.6	17.02	14	3
Feb-1999	6.8	10.8	9.1	16.62	11	3
Mar-1999	9.1	14.1	11.6	16.14	9	3
Apr-1999	11.9	N/A	N/A	15.35	3	3
May-1999	16.4	N/A	N/A	15.20	2	3
Jun-1999	14.2	11.7	9.8	16.47	13	3
Jul-1999	11.1	14.4	11.8	16.11	10	3
Aug-1999	12.7	15.1	12.3	16.03	8	3
Sep-1999	10.3	9.9	8.4	16.79	14	3
Oct-1999	10.3	8.3	7.2	17.28	14	3
Nov-1999	9.0	8.3	7.2	17.25	14	3
Dec-1999	9.1	9.1	7.9	16.94	14	3
Jan-2000	8.1	10.5	8.9	16.67	14	3
Feb-2000	9.6	11.8	9.9	16.45	13	3
Mar-2000	10.6	14.8	12.1	16.06	12	3
Apr-2000	10.4	12.9	10.6	16.30	14	3
May-2000	9.3 *(11.0)*	14.6 *(15.0)*	11.9 *(12.2)*	16.09 *(16.05)*	11 *(14,11,13,12)*	3 *(3,3,3,3)*
Jun-2000	12.4	N/A	N/A	15.31	6	3
Jul-2000	10.8	17.0	13.7	15.83	6	3
Aug-2000	9.4	14.1	11.6	16.14	10	3
Sep-2000	10.2	13.5	11.1	16.22	11	3
Oct-2000	8.8	8.3	7.2	17.49	13	3
Nov-2000	7.5	8.8	7.6	17.01	14	3
Dec-2000	6.0	11.2	9.4	16.55	9	3

Notes:

(1) Average Stage is calculated using stage elevations at three stations on the sampling date.

(2) The italicized values in parentheses for May-2000 include the Lake Okeechobee Recession special sampling data.

(3) Highlighted values indicate months when exceedances occurred.

EVERGLADES NATIONAL PARK

SUMMARY

MAP

Shark River Slough

The Settlement Agreement of 1991 set separate interim and long-term total phosphorus concentration limits for discharges into the Everglades National Park through Shark River Slough to be met by October 1, 2003, and December 31, 2006, respectively. The limits apply to the water year ending September 30. The long-term total phosphorus concentration limit for inflows to Shark River Slough through structures S12A, S12B, S12C, S12D and S333 represents the concentrations delivered during the Outstanding Florida Waters baseline period of March 1, 1978, to March 1, 1979, and is adjusted for variations in flow. In addition, the Settlement Agreement requires that phosphorus concentrations be presented as 12-month moving flow-weighted means.

Inflow concentrations of total phosphorus through Shark River Slough are compared to the interim and long-term limits at the end of each water year from 1989 to 2000 (**Figure 26a**). The 12-month moving flow-weighted mean total phosphorus concentration ending September 2000 was 10.0 ppb. Corresponding interim and long-term limits were 9.4 and 7.6 ppb, respectively. This is the first time since 1993 that both limits were exceeded for the water year ending in September.

Table 7 presents the moving flow-weighted mean concentrations for each 12-month period beginning with December 1998 as well as the corresponding interim and long-term total phosphorus concentration limits, which are calculated using the 12-month period flow. For the 12-month periods ending in October, November and December 2000, the flow-weighted mean total phosphorus concentrations were 10.3, 11.7 and 12.7 ppb, respectively. These concentrations were all greater than the interim and long-term limits for these respective months.

The Settlement Agreement stipulates that the percent of flow-weighted mean total phosphorus concentrations greater than 10 ppb from each sampling event in any 12-month period must not exceed an allowable value based on flow into Shark River Slough for the same 12-month period (**Figure 26b**). For the 12-month

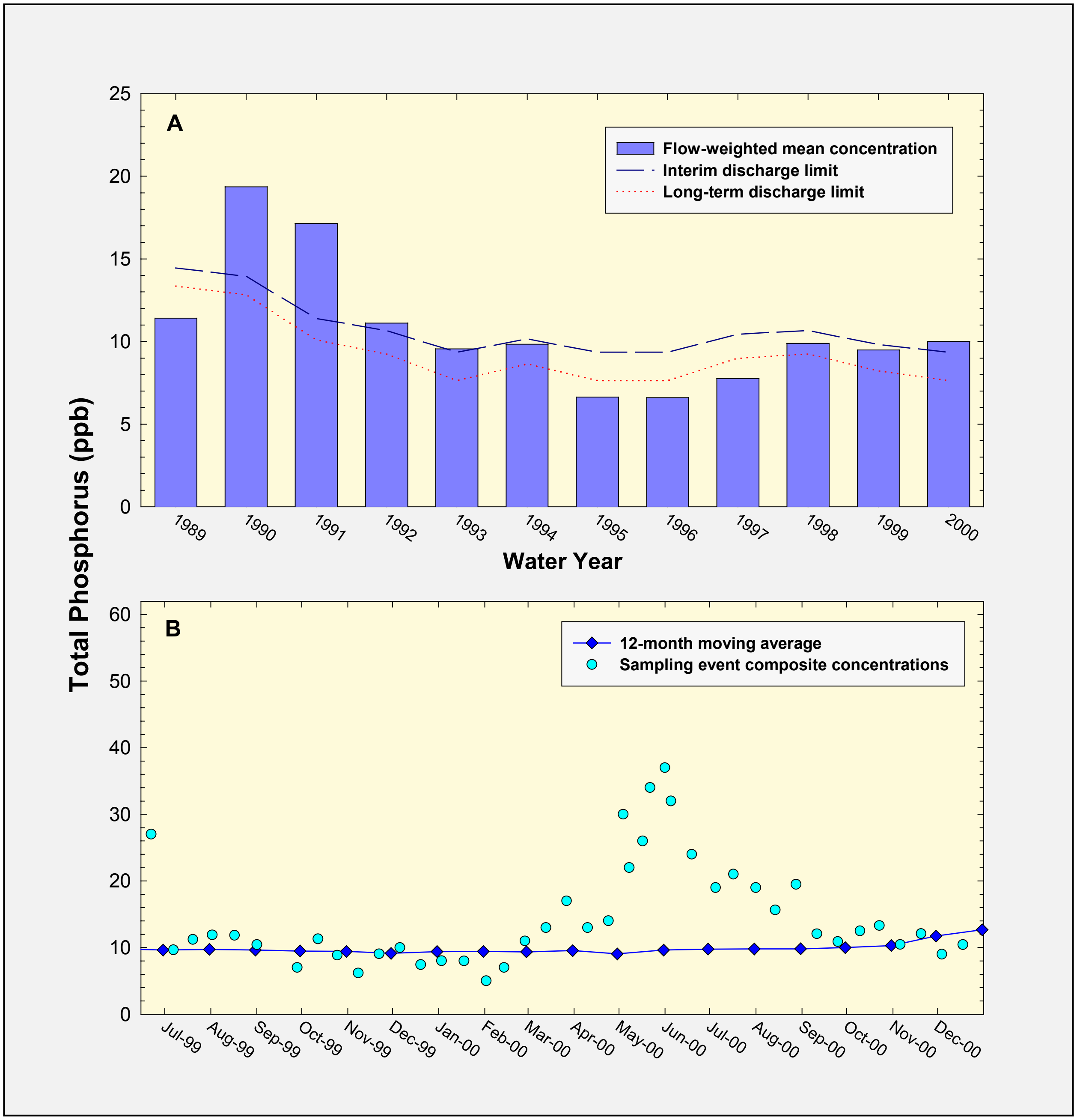


Figure 26. 12-month moving flow-weighted mean total phosphorus concentrations at the inflows to Everglades National Park (ENP) through Shark River Slough compared to the interim and long-term targets. **a.** Concentration at the end of each water year. **b.** 12-month moving average concentration at the end of each month and the composite concentration for each sampling event.

Table 7. Shark River Slough Total Phosphorus Compliance Tracking.

12-Month Period Ending On	Total Period Flow (Kac-ft)	Flow Weighted Mean Total Phosphorus (ppb)	Limits (ppb)		Percent of Samples Greater Than 10 ppb (%)	
			Interim	Long Term	Observed	Allowed
12/31/98	871.4	9.7	10.1	8.6	***57.1***	44.5
1/31/99	852.7	9.4	10.2	8.7	***53.6***	45.0
2/28/99	842.9	9.3	10.2	8.7	***55.6***	45.3
3/31/99	826.7	9.1	10.3	8.8	***51.9***	45.7
4/30/99	750.3	9.9	10.6	9.2	***51.9***	47.7
5/31/99	674.6	9.8	11.0	9.6	48.0	49.9
6/30/99	680.2	9.6	10.9	9.6	40.9	49.7
7/31/99	788.4	9.7	10.4	9.0	41.7	46.7
8/31/99	857.6	9.6	10.1	8.6	39.1	44.9
9/30/99	939.9	9.5	9.8	8.2	39.1	42.9
10/31/99	1084.4	9.4	9.4	7.6	39.1	40.1
11/30/99	1297.5	9.1	9.4	7.6	39.1	40.1
12/31/99	1344.8	9.4	9.4	7.6	39.1	40.1
1/31/00	1395	9.4	9.4	7.6	39.1	40.1
2/29/00	1415	9.4	9.4	7.6	***41.7***	40.1
3/31/00	1386	9.6	9.4	7.6	***52.2***	40.1
4/30/00	1385	9.1	9.4	7.6	***52.2***	40.1
5/31/00	1401	9.6	9.4	7.6	***57.7***	40.1
6/30/00	1396	9.8	9.4	7.6	***60.7***	40.1
7/31/00	1295	9.8	9.4	7.6	***64.3***	40.1
8/31/00	1215	9.8	9.4	7.6	***65.5***	40.1
9/30/00	1096	10.0	9.4	7.6	***69.0***	40.1
10/31/00	925	10.3	9.9	8.3	***72.4***	43.2
11/30/00	642	11.7	11.1	9.8	***79.3***	50.8
12/31/00	464	12.7	12.0	10.8	***82.8***	56.4

Bold and italicized values exceeded allowed percentage

periods ending October, November and December 2000, the percent of flow-weighted mean total phosphorus concentrations greater than 10 ppb was 75.9, 82.8 and 86.2, respectively. These percentages exceeded the allowable limits for all three 12-month periods (**Table 7**).

The daily mean flows through the individual Shark River Slough structures and S334 from July 1999 through December 2000 are presented in **Figure 27a**. As indicated in **Figure 27a**, the majority of flow in October entered northeastern Shark River Slough through the S12 structures. This change in inflow distribution compared to the previous seven months was due to a significant increase in flow resulting from heavy rainfall from October 2 to 4 (see rainfall data in **Table 1**). From the second week in November through December 31, inflows decreased due to very little rainfall. The relationship between the sum of the daily mean flows at Shark River Slough structures and the corresponding flow-weighted mean total phosphorus concentrations for individual sampling events is presented in **Figure 27b**. As can be seen in **Table 7**, decreasing monthly total flows into Shark River Slough from May through December 2000 have resulted in gradually increasing total phosphorus flow-weighted mean concentrations as well as an increase in the percentage of individual sampling date composite concentrations greater than 10 ppb.

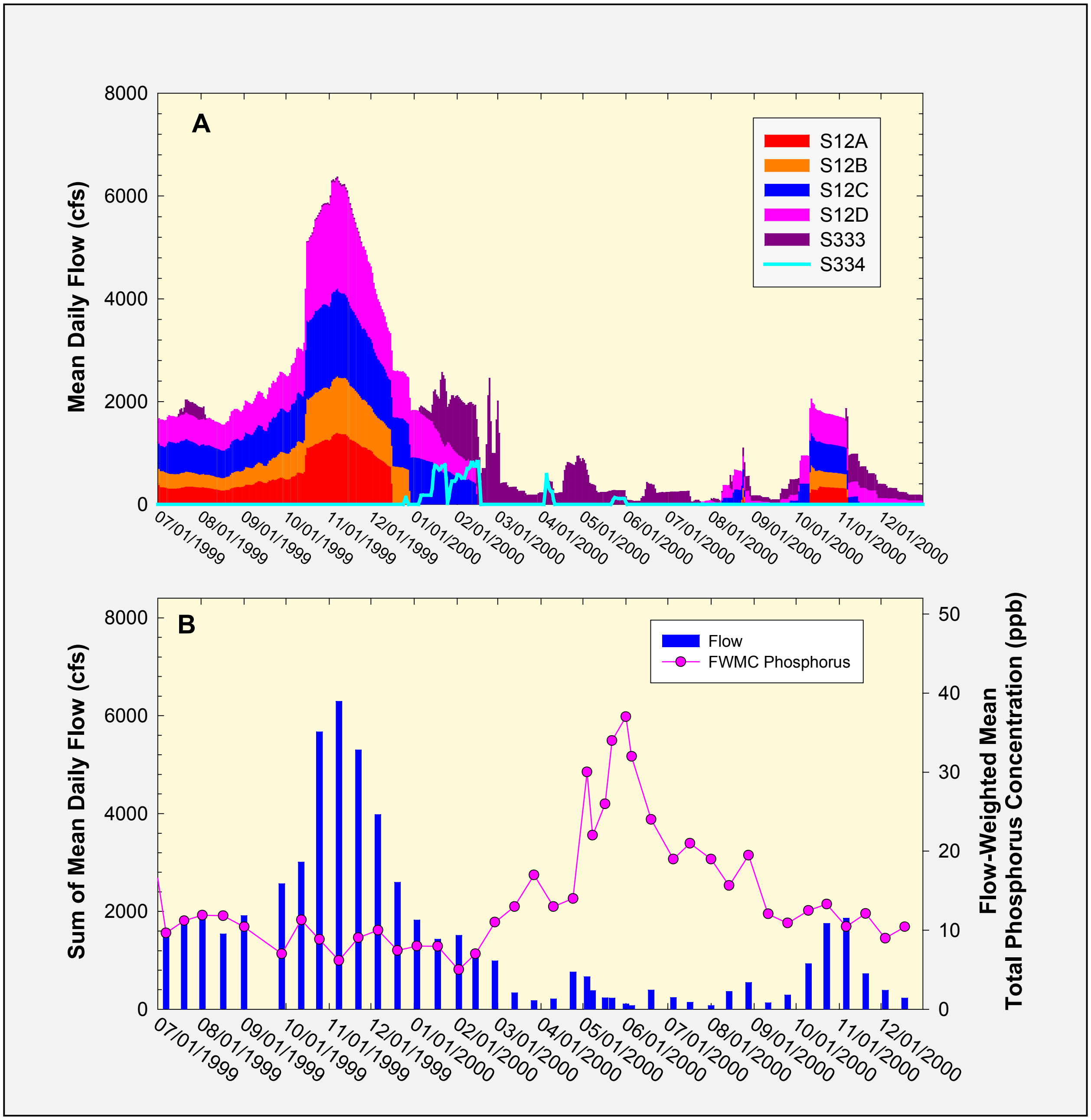


Figure 27. **a.** Mean daily flows into Shark River Slough by structure. **b.** The relationship between sum of mean daily flow at Shark River Slough structures and flow-weighted mean total phosphorus concentration for individual sampling events.

Taylor Slough and The Coastal Basins

Under the Settlement Agreement, a single total phosphorus long-term limit of 11 ppb, to be met by December 31, 2006, was set for the two points of inflow to Taylor Slough (S332 and S175) and the inflow point to the Coastal Basins (S18C). The 11 ppb limit applies to the water year ending September 30. Beginning in August 1999, structure S332D, a new pump station constructed by the U.S. Army Corps of Engineers, began operation. The structure is adjacent to spillway S174 and pumps water from the L31N canal into the L31W canal. The S332D and S174 structures became the new inflow compliance monitoring sites for Taylor Slough on October 1, 1999, replacing S332 and S175. However, the Settlement Agreement's Technical Oversight Committee requested that data from both the old and new pairs of inflow structures to Taylor Slough be presented for one year. This request was made to determine if the differences between the two data sets observed from August 1999 through March 2000 would continue throughout a complete wet season/dry season cycle and what implications this might have on future compliance with the 11 ppb limit.

Inflow concentrations of total phosphorus to the Everglades National Park through Taylor Slough and the Coastal Basins are compared to the 11 ppb limit at the end of each water year using data from both the old (S175, S332, S18C) and new (S174, S332D, S18C) combinations of structures for the 2000 water year (**Figure 28a**). The bars in **Figure 28a** represent the flow-weighted mean total phosphorus concentrations from S332, S175 and S18C for water years 1989 through 2000. The diamond point value for water year 1999 represents the total phosphorus concentrations for S174 and S18C from October 1, 1998 through September 30, 1999 plus the S332D data from August 30, 1999 through September 30, 1999. The diamond point value for 2000 represents total phosphorus concentrations for the entire year from S174, S332D and S18C.

Figure 28b presents the 12-month moving average and individual sampling event flow-weighted mean total phosphorus concentrations at both the old and new combinations of structures. The individual sampling event data for the new combination had been generally greater than those from the old combination through June 2000. From July through December 2000 the individual sampling event data from the new combination has been consistently lower than the old combination.

The 12-month flow-weighted mean concentrations for October, November and December 2000 were 7.9, 7.7 and 7.7 ppb, respectively, at the new combination of structures and 7.9, 8.1 and 8.4 ppb, respectively, for the old combination of structures (**Table 8**). The Settlement Agreement stipulates that the percent of flow-weighted mean total phosphorus concentrations greater than 10 ppb from each sampling event in any 12-month period must not exceed a fixed value of 53.1 percent. The percentage of flow-weighted mean total phosphorus concentrations greater than 10 ppb for the new combination was 11.4, 12.2 and 12.5 for the periods ending October, November and December, respectively. For these same periods, the percentage for the old combination was 12.1, 13.8 and 14.3, respectively (**Table 8**).

A comparison of flows between the old and new combination of structures is presented in **Figure 29**.

The flow through S18C, along with the combined flows through S332 plus S175 and S332D plus S174, is presented in Figure 25a. The water discharged from the downstream structures, S175 and S332, is supplied through the upstream structures, S174 and S332D. After July 5, 2000 S332 and S175 were closed. Thereafter, flow into Taylor Slough was through S322D until November 27. From November 28 through December 9 inflows to Taylor Slough were through S174. From December 10 through December 31 there were no inflows through S332D or S174. Flows through S18C were continuous except from November 29 through December 9 when flows were diverted through S174. **Figure 29b** shows the relationship between the sum of the daily mean flows at S18C and the Taylor Slough structures and the corresponding flow-weighted mean total phosphorus concentrations for each sampling event at both the old and new combinations of structures.

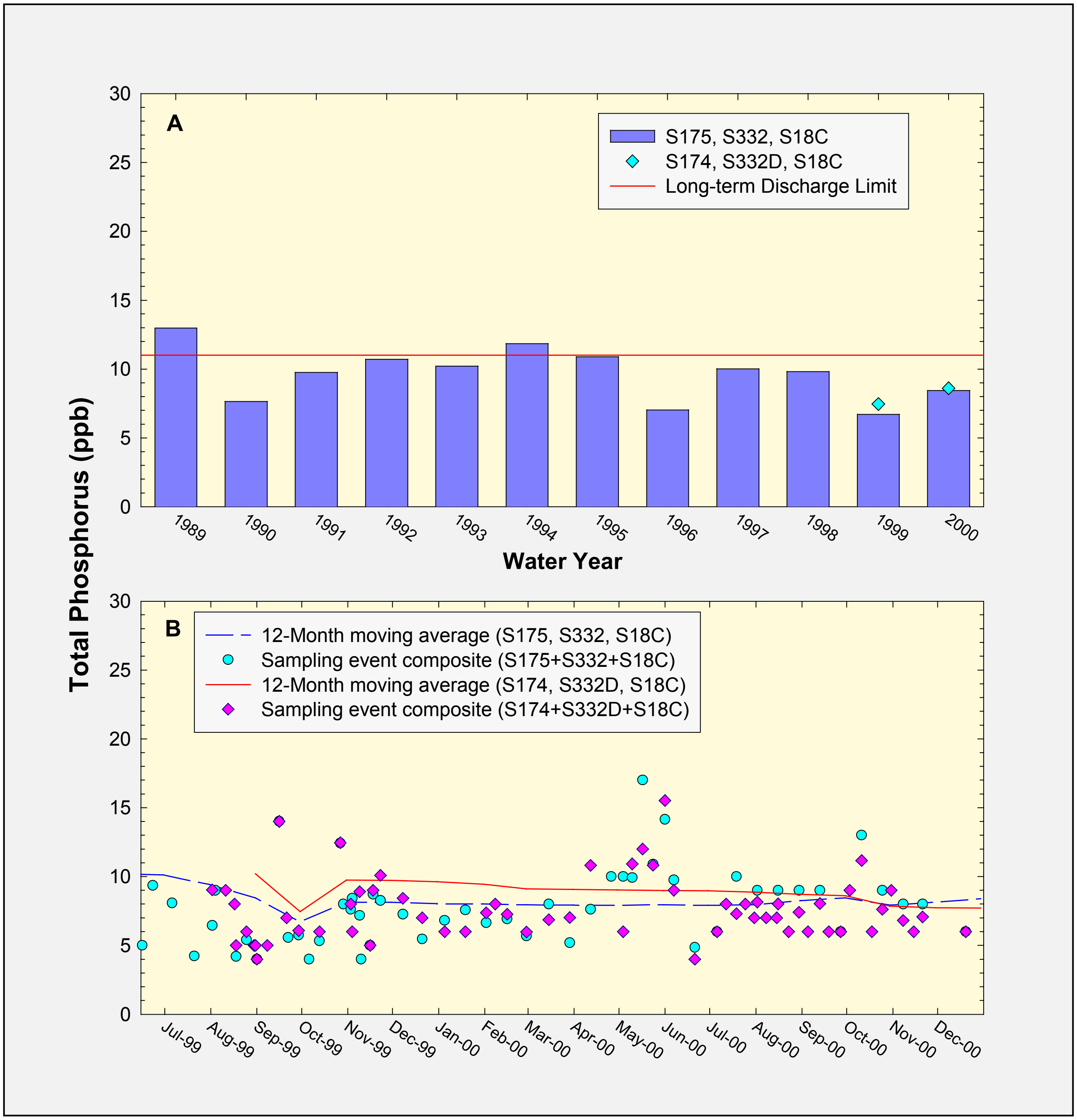


Figure 28. **a.** Flow-weighted mean total phosphorus concentration at the inflows to Everglades National Park through Taylor Slough and the Coastal Basins compared to the 11 ppb long-term total phosphorus limit for each water year. **b.** The 12-month moving average and individual sampling event flow-weighted mean total phosphorus concentraions at both the old and new combinations of compliance monitoring sites.

Table 8. Taylor Slough and Coastal Basins Total Phosphorus Compliance Tracking.

12-Month Period Ending On	Total Period Flow (ac-ft x 10^3)		Flow Weighted Mean Total Phosphorus (ppb)		Long Term Limit (ppb)	Percent of Samples Greater Than 10 ppb			
						Observed (%)		Allowed (%)	
	New	Old	New	Old		New	Old	New	Old
12/31/98	81.29	318.7	11.7	9.9	11.0	38.5	32.1	53.1	53.1
1/31/99	97.67	329.8	11.4	9.8	11.0	34.6	28.6	53.1	53.1
2/28/99	90.69	306.5	12.0	9.6	11.0	30.8	25.0	53.1	53.1
3/31/99	82.6	272.1	12.4	9.9	11.0	26.9	21.4	53.1	53.1
4/30/99	74.57	251.6	12.9	10.0	11.0	33.3	25.0	53.1	53.1
5/31/99	63.4	232.1	13.8	10.2	11.0	40.0	28.6	53.1	53.1
6/30/99	70.04	259.5	13.6	10.1	11.0	44.0	28.6	53.1	53.1
7/31/99	75.96	275.6	12.1	9.4	11.0	37.0	25.0	53.1	53.1
8/31/99	78.96	287.7	10.2	8.5	11.0	25.0	16.7	53.1	53.1
9/30/99	94.00	279.9	7.5	6.7	11.0	17.7	12.1	53.1	53.1
10/31/99	101.66	338.8	9.7	8.1	11.0	22.9	17.1	53.1	53.1
11/30/99	111.70	365.2	9.7	8.1	11.0	23.1	15.4	53.1	53.1
12/31/99	127.20	413.6	9.6	8.0	11.0	22.5	15.4	53.1	53.1
1/31/00	144.3	450.0	9.5	8.0	11.0	22.5	15.4	53.1	53.1
2/29/00	160.0	479.2	9.1	7.9	11.0	21.4	15.0	53.1	53.1
3/31/00	164.5	485.4	9.1	7.9	11.0	22.0	15.4	53.1	53.1
4/30/00	164.8	492.7	9.0	7.9	11.0	20.0	12.8	53.1	53.1
5/31/00	170.2	493.4	9.0	8.0	11.0	23.3	14.6	53.1	53.1
6/30/00	161.7	467.3	9.0	7.9	11.0	23.3	16.7	53.1	53.1
7/31/00	172.9	456.6	8.9	8.0	11.0	20.5	17.1	53.1	53.1
8/31/00	184.2	445.1	8.7	8.3	11.0	20.9	18.0	53.1	53.1
9/30/00	188.0	432.1	8.6	8.4	11.0	19.1	14.3	53.1	53.1
10/31/00	194.8	374.8	7.9	7.9	11.0	15.9	12.1	53.1	53.1
11/30/00	182.3	315.0	7.7	8.1	11.0	14.6	13.8	53.1	53.1
12/31/00	163.0	265.9	7.7	8.4	11.0	15.0	14.3	53.1	53.1

New= S174+S332D+S18C data
Old = S175+S332+S18C data

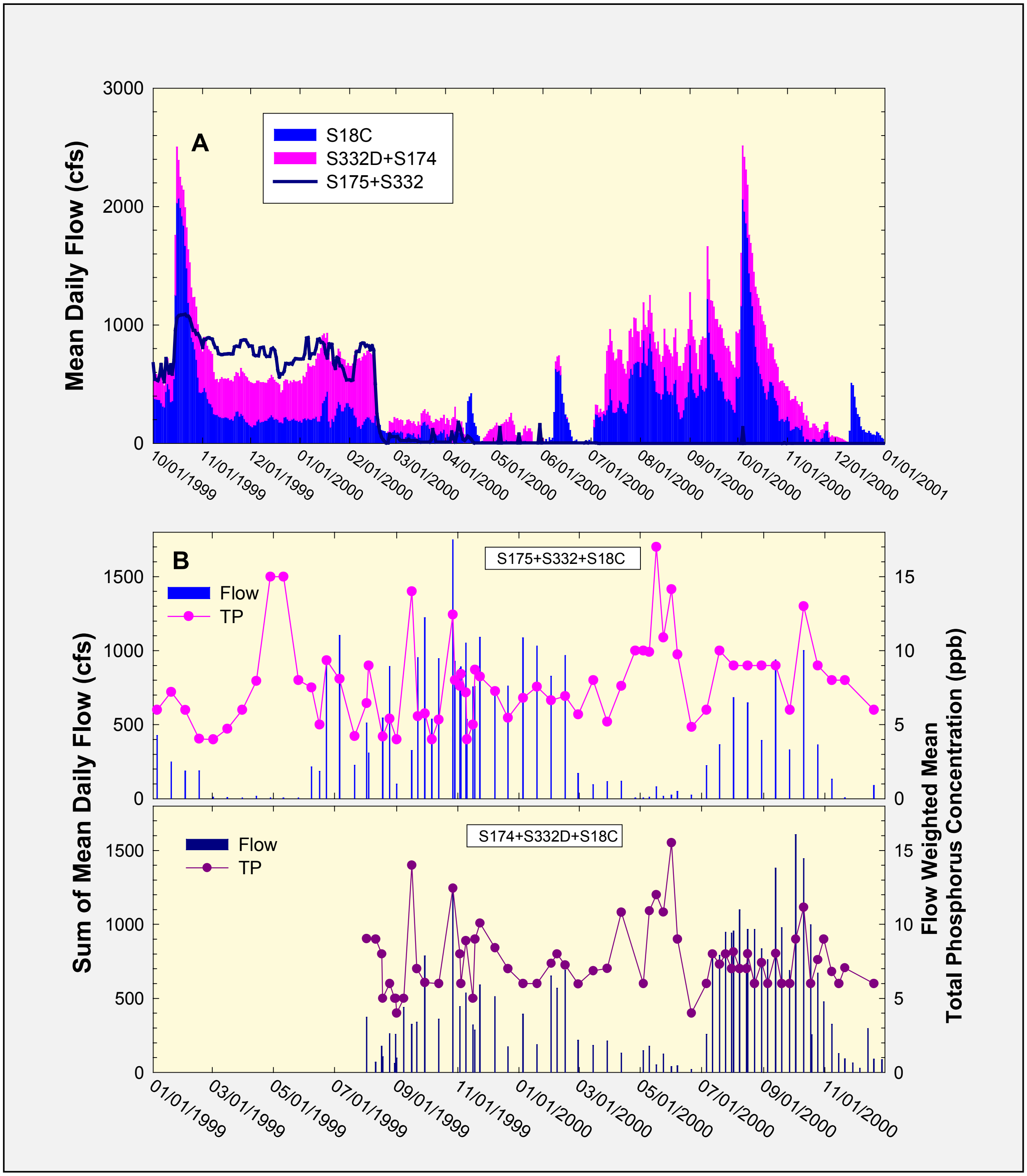


Figure 29. **a.** Daily mean flows into Everglades National Park through Taylor Slough and S18C, the Coastal Basins control structure. **b.** Mean daily flows and corresponding flow-weighted mean total phosphorus concentrations at old and new combinations of Taylor Slough and Coastal Basin structures.

FLORIDA BAY

SUMMARY

MAP

The South Florida Water Management District, in collaboration with the Everglades National Park and Florida International University, monitors water quality in Florida Bay to track the influences of fresh water inflows to the bay. Salinity and chlorophyll *a* are used as indicators of water quality within Florida Bay.

Salinity

As an estuary, Florida Bay requires a properly maintained salinity regime for the overall ecological health of the bay. Salinity can be defined as the grams of salt dissolved in a kilogram of water and is expressed in units of parts per thousand (ppt). Within the bay, salinity is affected by freshwater input, in the form of rainfall and surface water runoff from the Everglades, and transport of seawater into the bay predominantly from the Gulf of Mexico. Because the bay is a shallow and wide lagoon, evaporation also affects salinity levels. When evaporation exceeds freshwater input, portions of the bay can become hypersaline. Water conditions in the bay are considered hypersaline when salinity exceeds 35 ppt, which is the approximate mean salinity of ocean water. The central portion of the bay contains small basins surrounded by shallow seagrass banks that extend toward the western edge of Florida Bay. Because of the bathymetry of this region, it is especially susceptible to hypersaline conditions.

In **Figure 30**, historical (1991 – 1999) mean and range of salinity values at nine monitoring stations in Florida Bay are compared with their monthly mean salinity values for 2000. Stations selected for this comparison lie along a west to east transect and depict salinity changes with lateral distance from the western boundary of the ENP (*i.e.*, Gulf of Mexico) to the eastern boundaries of Florida Bay.

During the 2000-monitoring year, only two salinity values were greater the historical range. Both values were observed at the East Cape site (**Figure 30**) and occurred during August and September. Salinity values were generally higher than the historic mean along the western and central portions of the transect. In contrast, salinity values were equally distributed about the historic mean for the eastern portion of the transect. Within the eastern portion of the bay, freshwater inflows have a greater affect of the salinity regime than in the central or western portions.

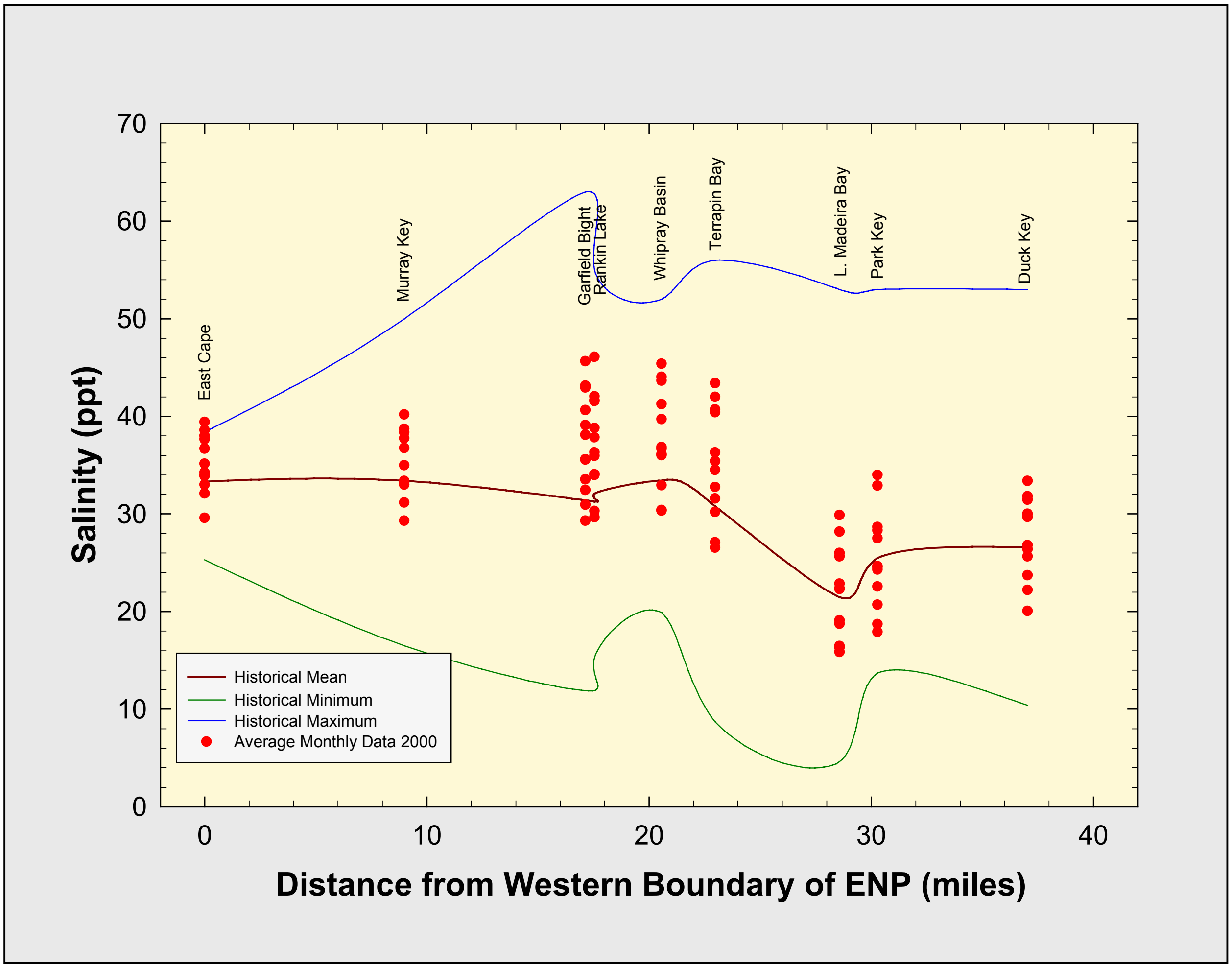


Figure 30. Comparison of historic salinity (1991-1999) with monthly means measured in 2000 at nine monitoring stations in Florida Bay along a west to east transect.

Maps showing salinity contours within Florida Bay from October through December 2000 are depicted in **Figures 31a** through **31c**. Overall, salinity in Florida Bay during the fourth quarter of 2000 ranged from less than 0.1 to 39.3 ppt.

Salinities greater than 35 ppt were observed in Florida Bay during all three months of the fourth quarter of 2000 (**Figures 31a** through **31c**). Bay-wide salinities measured for the fourth quarter averaged 20.8, 21.5 and 24.0 ppt in October, November and December, respectively. The lower average salinity for October probably reflects rainfall and freshwater inflow to the bay associated with a poorly organized subtropical disturbance, which passed through south Florida in first week of the month.

Hypersaline conditions predominated in the central portion of Florida Bay. The number of stations in this portion of the bay with salinities greater than 35 ppt decreased throughout the fourth quarter. High rainfall during early October, as well as high freshwater inflows, contributed to the relatively low salinity levels observed in most of the bay, especially in the eastern portion.

Salinity levels measured over the last three years at monitoring sites in Highway Creek, Duck Key, Little Madeira Bay and Whipray Basin are presented in **Figure 32**. A summary of salinities recorded for the fourth quarter of 2000 at these monitoring sites is also presented in **Table 9**. No samples were collected at Highway Creek or Duck Creek during the November monitoring event. Salinities at (Duck Key and Whipray Basin) fluctuated by less than 1 ppt throughout the fourth quarter (**Figure 32**). A decrease in freshwater inflow to Highway Creek during December 2000 contributed to an increase in salinity at this site (**Table 9**). Salinity varied by approximately 4 ppt in Little Madeira Bay during the fourth quarter. In November, salinity decreased at this site to approximately 19 ppt. By December, salinity had rebounded to 22 ppt (**Figure 32**).

Table 9. Salinity (ppt) in Florida Bay

	Oct-00	Nov-00	Dec-00
Highway Creek	4.1	-ND-	6.9
Duck Key	26.8	-ND-	26.4
L. Madeira Bay	22.3	18.8	22.4
Whipray Basin	36.1	36.0	36.9

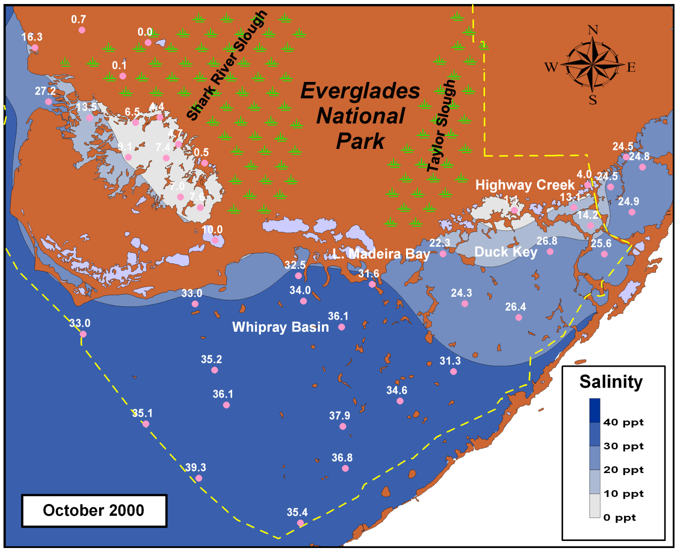


Figure 31a. Salinity in Florida Bay and the western coast of the Everglades National Park for October 2000 (Data collected by Florida International University.)

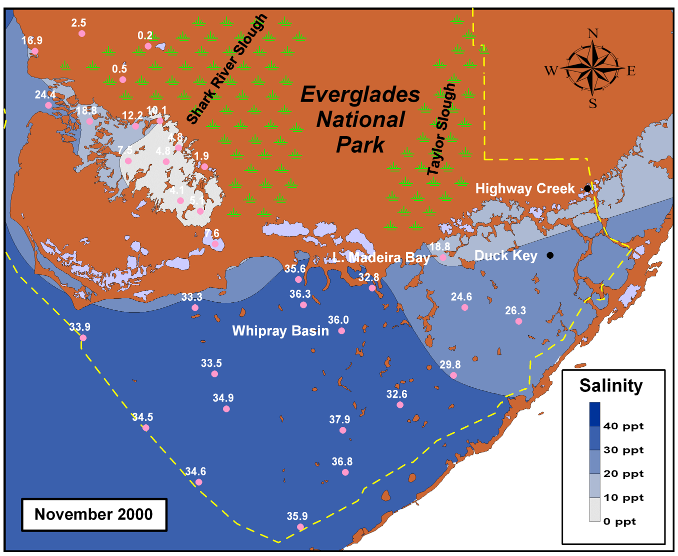


Figure 31b. Salinity in Florida Bay and the western coast of the Everglades National Park for November 2000 (Data collected by Florida International University.)

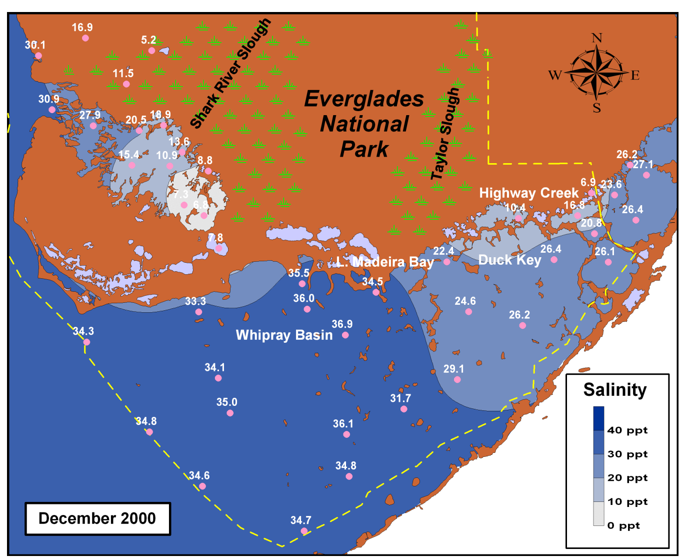


Figure 31c. Salinity in Florida Bay and the western coast of the Everglades National Park for December 2000 (Data collected by Florida International University.)

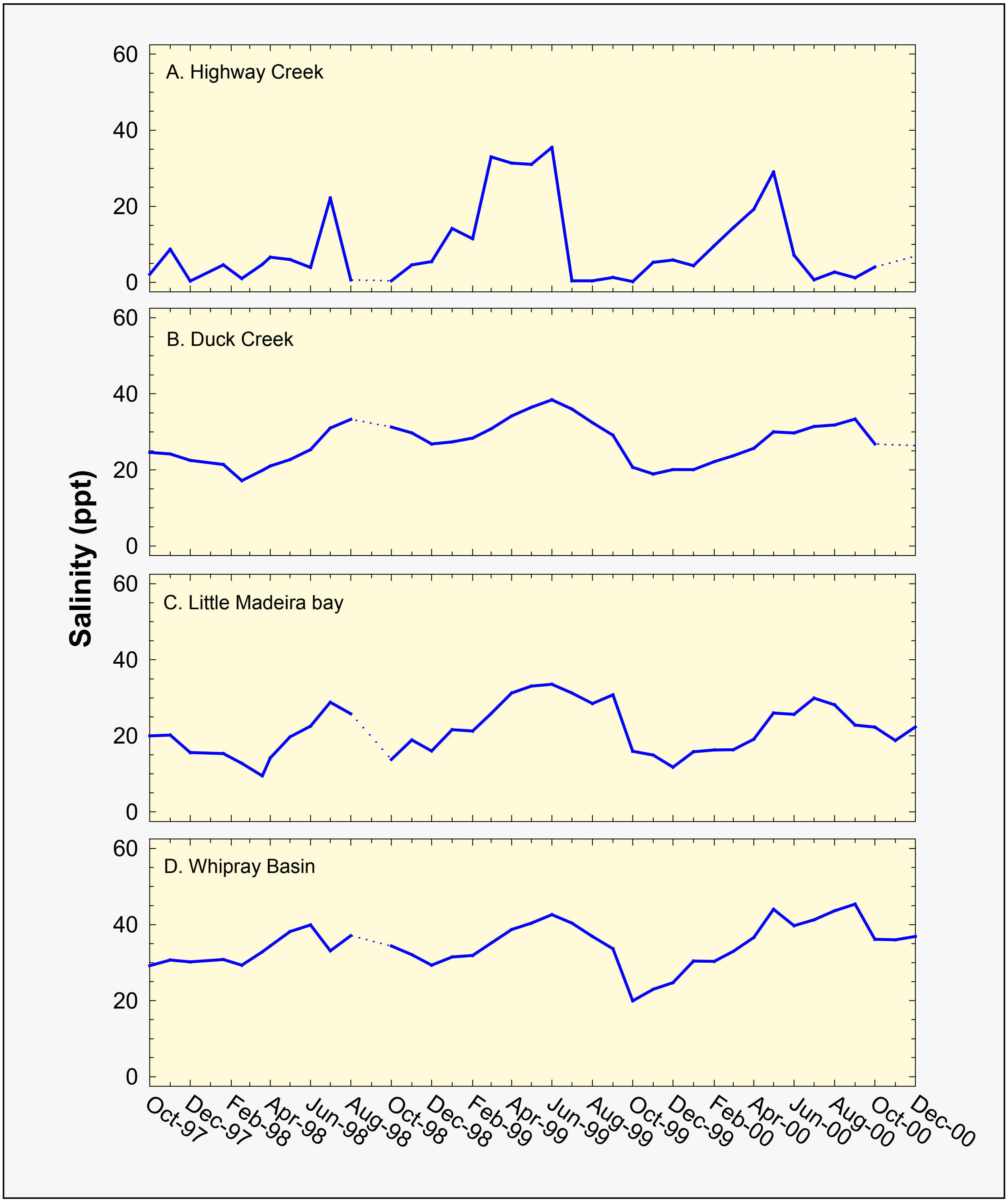


Figure 32. Salinity at four sites in Florida Bay from October 1997, through December 2000 (dashed lines indicate missing data).

Chlorophyll *a* Concentrations

Large areas of dense algal communities can affect the overall health of the Florida Bay ecosystem. Chlorophyll *a* concentrations measured in the bay are an indicator of algae (phytoplankton) biomass. Regional chlorophyll *a* concentrations in Florida Bay and the west coast of the Everglades National Park are collected monthly. The distributions of chlorophyll *a* levels measured in the bay during October, November and December are shown in **Figures 33a** through **33c.**

During the fourth quarter of 2000, chlorophyll *a* concentrations in Florida Bay averaged 1.0 parts per billion (ppb) and ranged from 0.1 to 6.0 ppb. Mean chlorophyll *a* concentrations in the bay increased from 0.8 ppb in October to 1.1 ppb in December 2000 (**Figure 33a** to **33c**). The eastern and southern portions of Florida Bay exhibited lower chlorophyll *a* levels. This trend has been reported in previous issues of this report. The highest chlorophyll *a* levels measured in Florida Bay during the fourth quarter were observed at Garfield Bight and Rankin Basin (both areas are located directly northwest of Whipray Basin)(**Figure 33c**). These higher chlorophyll *a* levels may be attributed to nutrient inputs to the bay from runoff as well as wind-induced, turbulent mixing resulting in the resuspension of sediments.

Chlorophyll *a* concentrations measured at four sampling stations in Florida Bay over the past three years of monitoring are shown in **Figure 34**. In addition, a summary of chlorophyll *a* concentrations measured during the fourth quarter of 2000 is provided in **Table 10**. In general, chlorophyll *a* levels measured at these sites during the fourth quarter of 2000 were lower than those measured for the same period the previous year.

During fourth quarter of 2000, Little Madeira Bay exhibited a decrease in chlorophyll *a* levels (**Table 10**). Meanwhile, chlorophyll *a* levels at Duck Key were relatively unchanged during this three-month monitoring period. Chlorophyll *a* levels at Highway Creek and Whipray Basin increased (**Table 10**).

During third quarter of 2000, Highway Creek exhibited a decrease in chlorophyll *a* levels (**Table 10**). Meanwhile, chlorophyll *a* levels at Duck Key and Little Madeira Bay were relatively unchanged during this three-month monitoring period. Chlorophyll *a* levels at Whipray Basin, however, increased from 0.8 to 1.2 ppb (**Table 10**).

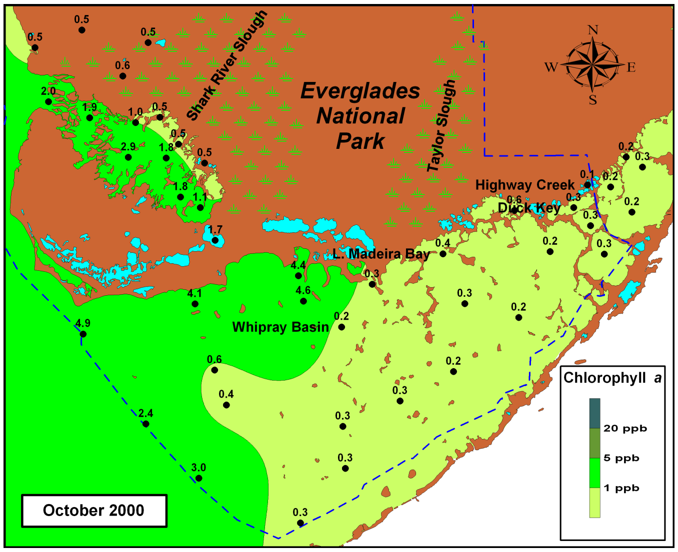


Figure 33a. Concentrations of chlorophyll *a* in Florida Bay and the western coast of Everglades National Park for October 2000. (Data collected by Florida International University.)

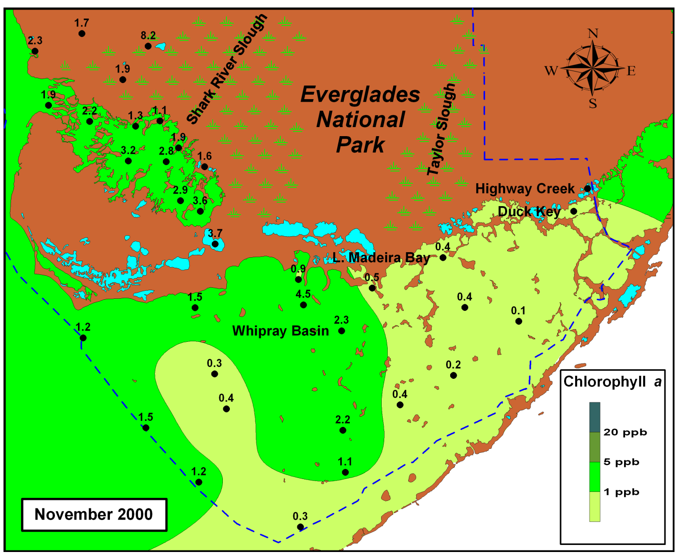


Figure 33b. Concentrations of chlorophyll *a* in Florida Bay and the western coast of Everglades National Park for November 2000. (Data collected by Florida International University.)

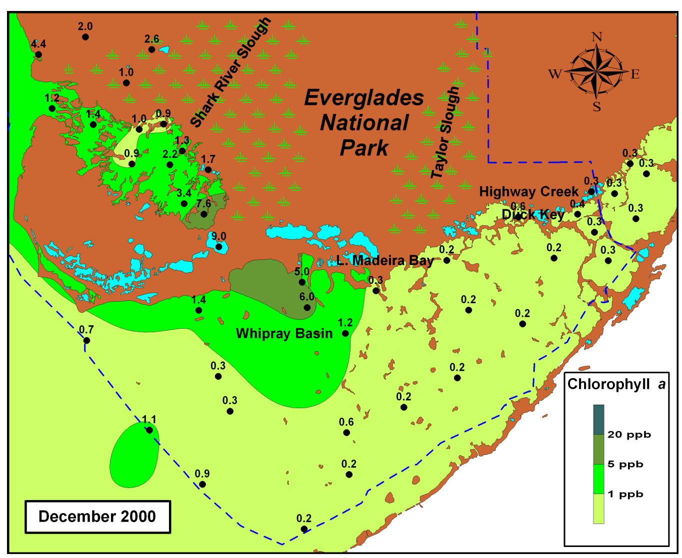


Figure 33c. Concentrations of chlorophyll *a* in Florida Bay and the western coast of Everglades National Park for December 2000. (Data collected by Florida International University.)

Table 10. Chlorophyll *a* (ppb) in Florida Bay

	Oct-00	Nov-00	Dec-00
Highway Creek	0.1	-ND-	0.4
Duck Key	0.2	-ND-	0.2
L. Madeira Bay	0.4	0.4	0.2
Whipray Basin	0.2	2.3	1.2

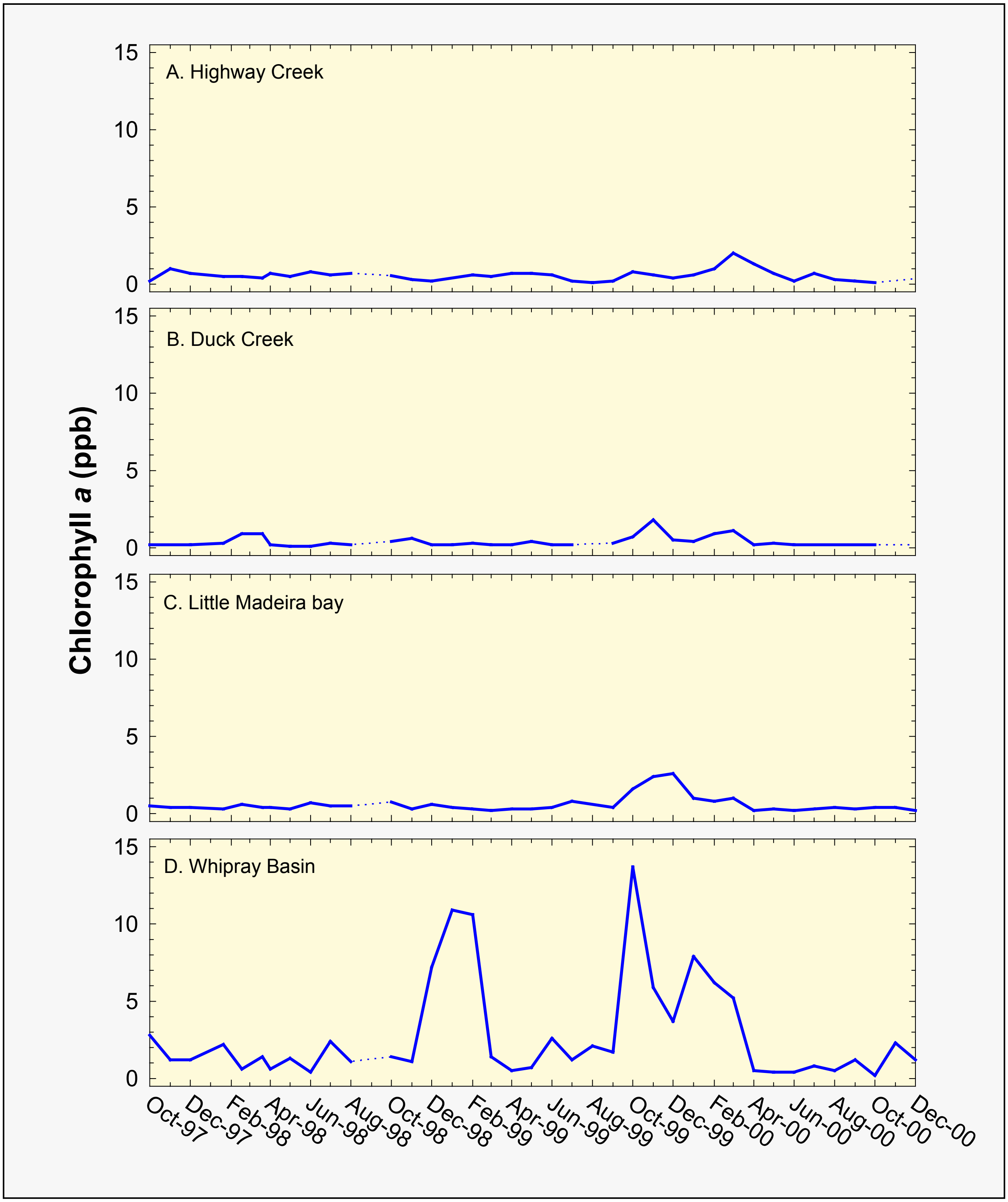


Figure 34. Chlorophyll *a* concentrations at four sites in Florida Bay from October 1997, through December 2000 (dashed lines indicate missing data).

PESTICIDE MONITORING PROGRAM

SUMMARY

MAP

As part of the District's quarterly ambient monitoring program, unfiltered water and sediment samples from 36 sites were collected from November 13 to November 16, 2000, and analyzed for over sixty pesticides and/or products of their degradation. The herbicides ametryn, atrazine, bromacil, hexazinone, norflurazon, and simazine, along with the insecticides/degradates atrazine desethyl, atrazine desisopropyl, alpha endosulfan, ethion, and ethoprop, were detected in one or more of these surface water samples. The herbicide ametryn, together with the insecticides/degradates aldrin, DDD, DDE, DDT, and ethion, were found in the sediment at several locations, along with one PCB compound.

The District's pesticide monitoring network includes stations designated in the Everglades National Park Memorandum of Agreement, the Miccosukee Tribe Memorandum of Agreement, the Lake Okeechobee Operating Permit, and the non-Everglades Construction Project (non-ECP) permit. The District's canals and marshes depicted in Figure 1 are protected as Class III (fishable and swimable) waters, while Lake Okeechobee is protected as a Class I drinking water supply. Water Conservation Area 1 (WCA1) and the Everglades National Park are also designated as Outstanding Florida Waters, to which anti-degradation standards apply. Surface water and sediment are sampled quarterly and semiannually, respectively, upstream at each structure identified in the permit or agreement.

Surface Water Findings

At least one pesticide was detected in surface water and sediment at 27 and 16 of the 36 and 33 sites, respectively. Sediment samples are not routinely collected at GORDYRD and CR33.5T. Field staff were not able to obtain a sediment sample at S9. The concentrations of the pesticides detected at each of the sites are summarized for the surface water and sediment in Tables 11 and 12, respectively. All these compounds have previously been detected in this monitoring program.

The ethion concentration of 0.026 .g/L at S99, exceeds the chronic toxicity level (0.003 μg/L) for *Daphnia magna* calculated according to promulgated procedure (FAC 62-302.200). *Daphnia magna* is a sensitive indicator species for aquatic macroinvertebrates. At this level, long term exposure can cause adverse effects on macroinvertebrate species, but the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long term average exposures. With the method detection limit around 0.02 μg/L, any detection will automatically exceed the calculated chronic toxicity (0.003 μg/L) for *Daphnia magna*.

Only alpha (α) endosulfan was detected in the surface water at four locations in the South Miami-Dade farming area during this sampling event. However, none of the concentrations exceeded the Florida Class III surface water quality standard (Chapter 62-302). Endosulfan was not quantified in the sediment at any of the sampling locations.

Some of the detected sediment concentrations of aldrin, DDD, DDE, and DDT, are usually associated with the potential for impacting wildlife when compared to coastal sediment quality assessment guidelines. One of the DDT and two of the DDD detections were of a magnitude considered to represent significant and immediate hazard to aquatic organisms in coastal sediments. However, there are no corresponding freshwater sediment quality assessment guidelines to further evaluate potential hazards at the District's sampling sites.

The above findings must be considered with the caveat that pesticide concentrations in surface water and sediment may vary significantly in relation to the timing and magnitude of pesticide application, rainfall events, pumping and other factors, and that this was only one sampling event. The possible long term or chronic toxicity impacts are also reported based on the single sampling event and do not take into account previous monitoring data.

Table 11. Summary of pesticide residues above the method detection limit found in surface water samples collected by the District in October 2000.

Date	Site	Flow	Compounds (µg/L)											Number of Compounds Detected at Site
			ametryn	atrazine	atrazine desethyl	atrazine desisopropyl	bromacil	alpha endosulfan	ethion	ethoprop	hexazinone	Norflurazon	simazine	
11/13/00	S18C	N	-	(0.011)	-	-	-	(0.0074)	-	-	-	-	-	2
	S178	N	-	(0.027)	-	-	-	(0.0028)	-	-	-	-	-	2
	S177	Y	-	(0.01)	-	-	-	(0.0043)	-	-	-	-	-	2
	S332	N	-	(0.027)	-	-	-	(0.004)	-	-	-	-	-	2
	S176	N	-	**(0.01)**	-	-	-	-	-	-	-	-	-	1
11/14/00	US41-25	N	-	-	-	-	-	-	-	-	-	-	-	0
	S12C	Y	-	-	-	-	-	-	-	-	-	-	-	0
	S31	N	-	-	-	-	-	-	-	-	-	-	-	0
	S9	N	-	-	-	-	-	-	-	-	-	-	-	0
	S331	Y	-	-	-	-	-	-	-	-	-	-	-	0
	G211	Y	-	-	-	-	-	-	-	-	-	-	-	0
	S99	N	-	-	-	(0.012)	(0.061)	-	(0.026)	-	-	0.74	0.062	5
	GORDYRD	N	-	-	-	(0.015)	(0.069)	-	-	-	-	0.74	0.11	4
	S80	N	-	-	-	-	(0.085)	-	-	-	-	0.48	0.1	3
	S2	N	**(0.018)**	**0.11**	**(0.023)**	-	-	-	-	-	-	-	**(0.014)**	4
	S3	N	(0.015)	0.15	(0.034)	(0.011)	(0.056)	-	-	-	-	-	(0.025)	6
	S4	N	(0.013)	0.13	(0.032)	(0.011)	(0.049)	-	-	-	-	-	(0.025)	6
11/15/00	S140	N	-	-	-	-	-	-	-	-	(0.061)	(0.041)	(0.014)	3
	S190	N	-	-	-	-	(0.057)	-	-	-	-	0.087	-	2
	G123	N	-	-	-	-	-	-	-	-	-	-	-	0
	S142	N	-	-	-	-	-	-	-	-	-	-	-	0
	S38B	N	**(0.014)**	**1.4**	**0.096**	-	-	-	-	-	-	-	-	3
	S79	N	-	0.043	-	-	1.1	-	-	-	-	0.38	0.18	4
	CR33.5T	Y	-	0.092	-	-	1.5	-	-	-	-	0.49	0.11	4
	S78	N	(0.028)	0.26	(0.021)	-	-	-	-	-	(0.026)	0.31	(0.019)	6
	S235	N	**(0.022)**	**0.1**	**(0.019)**	-	**(0.065)**	-	-	-	-	**(0.036)**	**0.068**	6
	FECSR78	N	-	-	-	-	-	-	-	-	-	-	-	0
	S65E	N	-	-	-	-	(0.079)	-	-	-	-	(0.02)	(0.036)	3
	S191	N	-	-	-	-	(0.044)	-	-	-	(0.025)	(0.028)	(0.026)	4
11/16/00	L3BRS	N	(0.011)	-	-	-	-	-	-	-	-	-	-	1
	S8	N	(0.021)	(0.027)	-	-	-	-	-	-	-	-	-	2
	S7	R	**(0.01)**	-	-	-	-	-	-	-	-	-	-	1
	S6	N	0.062	(0.013)	-	-	-	-	-	(0.041)	-	-	-	3
	S5A	N	0.045	0.043	-	-	-	-	-	-	-	-	0.27	3
	ACME1DS	N	0.039	-	-	-	-	-	-	-	-	-	-	1
	G94D	N	(0.035)	-	-	-	-	-	-	-	-	-	-	1
Total Number of Compound Detections			**13**	**16**	**6**	**4**	**11**	**4**	**1**	**1**	**3**	**11**	**14**	

Flows: N - no, Y - yes, R - Reverse; - Denotes that the result is below the MDL; bolded value represents the average of duplicate samples; value in parenthesis represents concentrations less than the minimum quantification limit and greater than or equal

Table 12. Summary of pesticide residues above the method detection limit found in sediment samples collected by the District in November 2000.

DATE	SITE	Compounds (µg/Kg)							Number of compounds Detected at Site
		aldrin	ametryn	DDD	DDE	DDT	ethion	PCB1254	
11/13/00	S177	-	-	-	8.9	-	-	-	1
11/14/00	S331	-	-	-	(3.1)	-	-	-	1
	S31	-	-	-	(3.8)	-	-	-	1
	G211	-	-	-	(4.0)	-	-	-	1
	S3	-	-	(5.1)	-	-	-	-	1
	S4	-	(20)	-	-	-	-	-	1
	S80	-	-	-	(8.4)	-	-	-	1
	S99	-	-	-	(1.4)	-	(9.2)	-	2
11/15/00	S79	-	-	-	(17)	-	-	(170)	2
	S190	-	-	-	(1.9)	-	-	(28)	2
	S142	-	-	-	(3.0)	-	-	-	1
11/16/00	ACMEIDS	(0.83)	-	(3.0)	7.9	-	-	-	3
	S5A	-	-	(34)	75	(3.2)	-	-	3
	S6	-	21	(64)	260	(8.5)	-	-	4
	L3BRS	-	-	-	(2.8)	-	-	-	1
	S8	-	(4.7)	-	4.3	-	-	-	2
Total number of compound detections		**1**	**3**	**4**	**14**	**2**	**1**	**2**	

- Denotes that the result is below the MDL; value in parenthesis represents concentrations less than the minimum quantification limit and greater than or equal to the minimum detection limit.

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GLOSSARY

12-month moving average
The mean (arithmetic average) of data from 12 consecutive months. As the latest month is added to the data set, the earliest month is dropped from the data set

5-year moving average
The mean (arithmetic average) of data from 5 consecutive annual averages of sums. When the latest year is added to the data set the earliest year is dropped from the data set.

flow-weighted mean

The arithmetic average adjusted for flow:

$$\bar{x} = \frac{\left(\sum_{i=1}^{i=n} q_i c_i\right)}{\left(\sum_{i=1}^{i=n} q_i\right)}$$

q = flow
c = concentration

geometric mean

The nth root of individual data values that have been multiplied:

$$G = \sqrt[n]{x_1 x_2 \ldots . x_n}$$

EC_{50}
A concentration necessary for 50 percent of the aquatic species tested to exhibit a toxic effect short of mortality within a short exposure period, usually 24 to 96 hours.

units of concentration measurement
(assuming density of water = 1.0)

grams/kilograms	(g/kg) =	1 part /thousand (ppt)
milligram/Liter	(mg/L) =	1 part/million (ppm)
microgram/Liter	(µg/L) =	1 part/billion (ppb)
nanogram/Liter	(ng/L)	

FOR MORE INFORMATION

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